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THE FREEING OF THE TROLLEY.

The United States Circuit Court of Appeals has handed down a decision in the suit of the Thomson-Houston Electric Company versus the Union Railway Company, involving the rights to the use of the overhead trolley. This is the case involving two claims of the famous Van Depoele patent, 495,443, over which there has been almost continuous litigation for several years. A brief history of the previous litigation and decisions in what are known as the Winchester Avenue case and the Hoosick Railway case was given in THE ELECTRICAL WORLD of February 19, 1898, in connection with the decision of Judge Lacombe, that decision being in favor of the General Electric Company and being the one appealed and just decided in favor of the Union Railway Company, the nominal appellant, the Walker Company being the real defendant. The decision is final, no further appeal being possible, and henceforth anyone can make or use the overhead trolley without paying royalties.

The main points of the case are as follows: The claims under dispute were Nos. 2 and 4 of the patent mentioned, specifying "the combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor and an arm carried by the car and carrying the contact device and pivoted so as to swing freely around a vertical axis." All the other claims of this patent, specifying in addition to the above means for upwardly pressing the arm, were in the Hoosick Railway opinion decided invalid through double patenting. The decision of Judge Lacombe rendered February 7, 1898, held that these two claims described an operative device, and as they did not specify means for pressing the trolley upward they were not invalidated by double patenting. Judge Lacombe held that although the device would not hold contact with the wire *automatically* it was none the less operative, because a boy seated on the roof of the car could impart the upward pressure. In the argument of the appeal just decided the attorneys for the Walker Company claimed that the device was inoperative unless means were provided for automatically pressing the trolley upward, in which case the claims would be invalidated as were the others of the same patent, and enjoyed no little fun at the expense of Judge Lacombe and his unfortunate reference to the boy, the far-fetched nature of which undoubtedly helped the appellant.

Although the decision is merely on a motion for preliminary injunction to prevent the Union Railway Company from using the overhead trolley while the main case is awaiting decision, this opinion, being based on a point of law, applies to the main case and renders the use of the trolley free from any fundamental patent claims, although there are, of course, plenty of details of construction still covered.

THE YEAR WITH THE BELL TELEPHONE COMPANY.

The revival of business activity and prosperity throughout the country has naturally been reflected in the business of the telephone companies. The annual report of the American Bell Telephone Company, which was abstracted in the last issue of THE ELECTRICAL WORLD, exhibits an increase in the earnings and an expansion of the system that is even greater than could be assigned to this cause, and must be most satisfactory to the stockholders. This is the more surprising on account of the increasing aggressiveness of the competition of the independent telephone companies, the satisfactory state of the business of the Bell Company in spite of this competition indicating a most vigorous condition of the industry as a whole.

While these results are gratifying it must be noted that for a corporation of such importance, the stock of which is regarded as a gilt-edged investment, the report leaves much to be desired in point of detail. The balance sheet is meagre. The extent of the parent company's investments in the stocks of the various operating companies is represented only by the line "stocks and bonds owned, $52,827,-205." Not only is three-fifths of the company's gross revenue derived from dividends upon the stocks of the controlled companies, but the large and steady increase in the parent company's share capital has been rendered necessary by the growth of the operating companies and the improvement of their facilities. The report states that the entire expenses for construction by companies with which it has relations amounted at the close of 1897 to no less than $97,946,-102, and it would certainly seem advisable to let the public and stockholders know exactly what the proportionate interest of the parent company is in each instance.

A considerable portion of the report is devoted to a discussion of the improvements effected in mechanical details, as well as of the steps taken to popularize the exchange system by the graduation of prices. The construction and expenses of the long-distance system up to December 31, 1897, are given as $13,888,751 and the gross increase of its earnings for the year is stated to have been $1,879,293, or about 16 per cent., but no details are given beyond these figures. It is noted, however, that new construction by all companies affiliated with the American Bell Telephone Company amounted during 1897 to over $8,700,000, of which $4,865,000 was for exchange constructions and $3,847,000 for toll lines. Altogether the report creates an impression that under existing conditions the parent company's ability to continue the payment of 15 per cent. dividends upon its $25,-886,000 of capital stock is not a matter of doubt. The fact, however, that increased demand for telephone facilities will call for further heavy expenditures of capital and that the clamor for lower prices through legislative interference can hardly be met by the practices of economical operation, such as are possible in many other industries, is a subject worthy of serious consideration in connection with telephone finances and the future position of the American Bell Company.

CIRCUIT BREAKERS.

Like Banquo's ghost the controversy between the advocates of the circuit breaker and the fuse will not down, the most probable reason being that each instrument has advantages that the other has not as yet been able to imitate. In another column will be found an abstract of a paper by Mr. Harry H. Cutler, in which these relative advantages and disadvantages are well pointed out. The chief advantage of the circuit breaker is that it is readily replaceable, is not affected by changes of temperature or of ventilation or draught and is much more accurately adjustable than is the fuse. It, however, is not affected by the immediate previous history of the circuit as is the fuse, and responds to any brief instantaneous current, a considerable disadvantage in apparatus designed to prevent overheating, since the heating effect of currents is cumulative, and, therefore, the temperature is not independent of the previous flow.

The combination of the advantages of the two might be obtained by means of circuit breakers controlled, not by the direct action of the main current in a solenoid acting upon the trigger, but by means of a relay designed to respond to the heating effect of the current in the main circuit. Such a relay could be readily made in many different forms and could be so lagged and protected that the heat generated by the current would be stored up in it for the same length of time as in the apparatus to be protected, or, in other words, the temperature of the relay on any and all currents could be made to vary in direct proportion to that of the apparatus protected, the relay being set to operate at a temperature corresponding to the safe limit of temperature of the devices under its protection.

Such a protecting device would have all the advantages of the circuit breaker, as well as those of the fuse, to even a greater extent than the fuse itself possesses them. A further incidental advantage would be that the relay combination after operating on a heavily loaded motor would, so to speak, on being reset, remember the heated condition of the motor and be ready to respond to any dangerous accession of heat which would not affect a new, cold fuse.

MOTOR STARTERS.

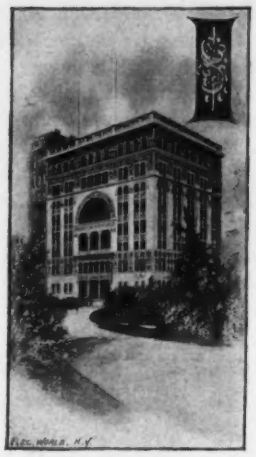
What is ordinarily known as an automatic motor starter might better be termed a motor stopper, the name really signifying a device by which, when the current is shut off, the full resistance of the starting rheostat is inserted in the circuit. An ideal automatic motor controlling mechanism would consist of a device so arranged that when the main switch is closed on the motor the resistance arm would move gradually from resistance all in to resistance all out, at which position it would remain until either the current was turned off or the motor was overloaded, in either of which cases it should again insert full resistance, and in case of overload preferably open the armature circuit. No such device is at present on the market.

In large modern power distribution motor systems all the motors are fitted with so-called automatic motor starters by which, in case the supply of power fails, resistance is inserted in the armature circuit of each motor. When the power is thrown on again the shunt fields are all fully excited, but to run the motors up to speed each rheostat in the whole system must be cut out by hand. A modification with many advantages which suggests itself in this connection is as follows: The system might be laid out with three wires instead of two, all shunt fields as well as all the lighting load being connected between two of these mains, all shunt motor armatures or series motors being attached to one of these two and the third main. All that would be necessary in starting up the system would be to fully excite the fields and then gradually raise the voltage across the armatures from the switchboard at the power plant by means of a separate generator or a heavy rheostat connected with the armature bus bar. This would do away with a multitude of automatic motor starters with their magnets, springs and mechanical complexity, and render the whole system controllable with absolute certainty from the main switchboard. The starting and stopping of all the machinery in a big factory twice a day could be effected in this way by one man at the switchboard instead of requiring attention from as many men as there are motors.

VOLUNTEER ELECTRICAL CORPS.

Capt. Eugene Griffin, vice-president of the General Electric Company, and formerly of the United States Army, has undertaken to organize a volunteer corps of electrical engineers and skilled electrical mechanics, and has already gotten the work well under way. The need of such a corps is anticipated in the event of actual hostilities for supplementing the work of the Battalion of Engineers in planting submarine mines in important harbors and for all emergency electrical signaling, lighting and power transmission work. Beside this there is a demand for skilled men to handle the electrical apparatus on shipboard, and for technical men to devise aids to rapid military manœuvres by electrical means. The response to Captain Griffin's request for volunteers has been most patriotic. Employees of the company with which the captain is connected were offered pay by the company during the period of service as well as their pay from the Government, with the privilege of taking up their old positions at the end of the military service. Other companies have been communicated with and in less than a week more than 1000 men have been enrolled. The addresses of all these volunteers have been sent to the office of the Chief of the Engineer Corps at Washington, and it is said some of the men have already been called upon for preliminary work.

The Electrical Equipment of the New York Athletic Club House.



IF only the part of the building above the street level is considered the New York Athletic Club has reason to be proud of its new home at the southeast corner of Sixth Avenue and Fifty-ninth Street, but the same can hardly be said of the architectural arrangements below the ground level. The mechanical equipment is confined to a part of the sub-basement with considerable area, but hardly high enough to enable a tall man to walk erect, and a space under the walk of ample height, but very limited floor area. In the latter the boilers, pumps and the electric light and power plant are located, while the space under the building proper is occupied by various filtering, cooling and draining machines and the electric elevators. The main building occupies a plot measuring approximately 120 feet on Fifty-ninth Street and 135 feet on Sixth Avenue, with a narrow extension on Fifty-eighth Street. Occupying about one-half of this area and extending down to the foundation is the immense swimming tank, which cuts the space for the mechanical equipment in two. Excavation for the building cut into an underground stream and it has been found impossible to build a waterproof flooring for the sub-cellar. All water entering is pumped to the sewer by two low service Worthington pumps with 14-inch water cylinders.

A novel solution of the peculiar space problems has been embodied in the boiler equipment, the only available place for which was the sidewalk vault, about 28 feet in height, but with such a cramped floor area that it was practically impossible to install the necessary capacity of horizontal boilers and leave room enough for other machinery. To meet these conditions three vertical boilers of the Manning fire-tube type are used. Each boiler is capable of evaporating 6000 pounds of water per hour, and is normally worked at 80 pounds pressure. The distinctive feature of this type of boiler is the enlarged water leg, completely surrounding the fire box and forming the base of the boiler shell. Each boiler has 220 2½-inch fire tubes, the diameter of the shell above the combustion chamber being only 6 feet 6 inches. From the grate to the top of the boilers is 19 feet 6 inches.

Located immediately beneath the sidewalk, the lowering and setting of these boilers was a simple matter. For use in tube-cleaning, etc., the hole through which each boiler was lowered has been finished and closed with a circular removable glass light iron cover weighing about one and one-half tons. By removing these the tops of the boilers are accessible from the walk for any purpose. The utilization of live steam for direct and indirect cooking purposes and also (after condensation and ammonia refrigeration) for drinking purposes is unique, and necessitates the filtering of all water supplied to the boilers.

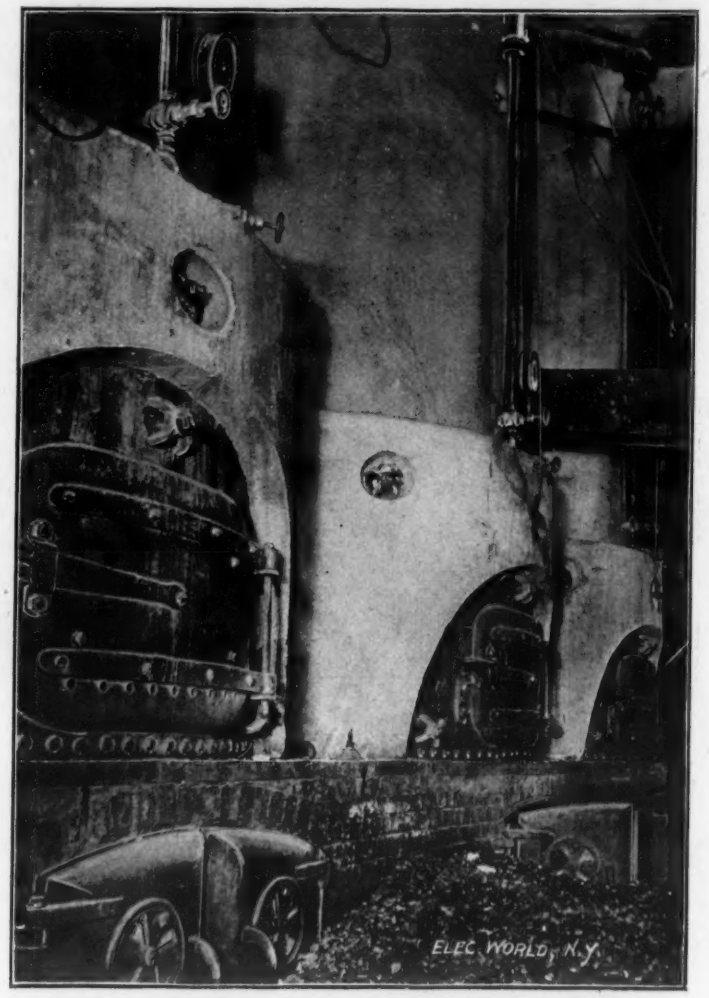
The filters are of the powdered quartz and charcoal type, with special reverse washing arrangements, and are known as the Continental filters. At present there are five of these filters, with a total capacity of 1,500,000 gallons daily. Not only is the water for the boilers treated in this manner, but every drop used throughout the building, even for the swimming pool, is similarly purified. Blake steam pumps are ordinarily used for boiler feeding, but the boilers are also equipped with Korting injectors. The feeding arrangements are such that any or all injectors or pumps may be used on any or all boilers. The feed pumps are placed between the boilers and the filters. Each boiler feeds into a large steam main and an auxiliary emergency main is provided and piped to several engines and pumps, so that in case of accident to the main line the entire plant would not be crippled. All condensation is returned to the boilers. The heating system may be supplied with live steam through a reducing valve, but exhaust steam is ordinarily used with the standard air exhaust and back pressure valve arrangement.

A Berryman feed-water heater is connected to the exhaust piping, but is simply tapped on, the exhaust steam not passing through it. Before entering the engine room proper the main steam line is bullheaded, and all taps to the engines and pumps are taken off from the top so that they may run direct without the necessity of steam separators.

The space devoted to engines and dynamos measures about 45 x 22 feet, with the same height as the boiler room. Eight dynamos and six engines comprise the electric light and power-generating machinery. Three 50 and one 30-kw dynamos are directly connected

THE SIDEWALK ABOVE THE BOILERS.

to 80 and 40-hp engines, while four other dynamos, two 30 kilowatt, one 20 kilowatt and one 50 kilowatt, are sleeved on a common shaft having an engine direct connected at each end. All dynamos are of the Crocker-Wheeler multipolar type and are driven by Ball & Wood simple horizontal engines. The three 50-kw separate units and also the one 50-kw generator on the common shaft are used for lighting and power, while the four smaller machines generate current for the four elevators, which are driven and controlled by the Leonard system of variable voltage supply. This allows the running of three elevators and a lighting dynamo by one direct-coupled



VIEW OF THE BOILER EQUIPMENT.

engine at times of light load. This shaft, which is 3 inches in diameter, measures 24 feet between the engines. It is centrally divided, the two halves being clutch connected. Two dynamos are mounted

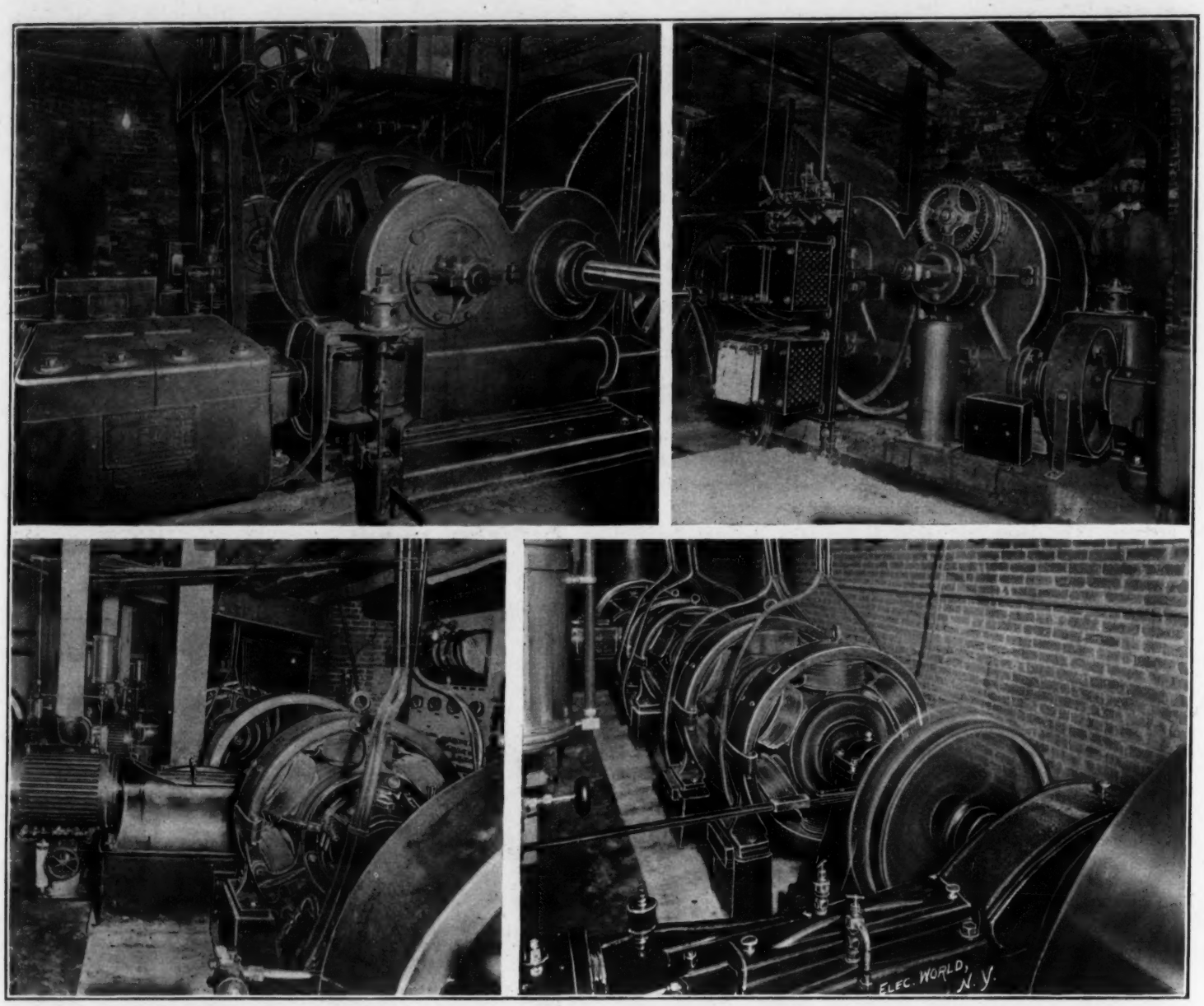
on each half, the armatures of each pair being fitted on one hollow sleeve revolving in bearings mounted on separate foundations. The engines are permanently coupled to their respective halves of the shaft and the sleeves are driven through clutch couplings. It is, therefore, possible to run either or both sets on either or both engines, which are of 80 horse-power each and operate the shaft at about 250 r. p. m.

From the various dynamos the conductors are at present run overhead in iron armored conduit to the switchboard located near the wall of the swimming tank. This overhead wiring is, however, only temporary, as conduits are to be placed under the floor.

The switchboard consists of three large panels of white marble and measures 16 feet from end to end and 7 feet in height. The two end panels are similar in design and function, the left panel serving the lighting and the right the elevator generators. The central panel might be termed a general distribution panel. All the eighteen indicating instruments are of the Weston-Van Vleck edgewise type, hinged to be tilted downward and arranged in sets, all voltmeters and all ammeters for each set of four dynamos being grouped together. Each dynamo has a separate volt and amperemeter. On the central panel there are a differential galvanometer and its switch, a ground detector and switch, a clock and a Bristol recording voltmeter. Carpenter enamel rheostats are used and each dynamo lead is protected by an I. T. E. single-pole circuit breaker located at the lower end of the dynamo panel. All main switches are double-pole, separate equalizer switches being used.

The connections of this switchboard are as follows: Each of the leads from the lighting machines is brought to the blade of a horizontally movable double-throw dynamo switch. These switches thrown one way connect their machines to the power bus and the other way to the light bus. Various feeder switches are connected to each of these buses, those for light being placed at the lower left hand side of the central panel and those for power on the right. A switch is provided for throwing the light and power buses together.

The dynamos for the elevator section have their leads brought to their respective double-pole switches in a similar fashion. The armature leads from each of the four elevator motors are separately connected to the blades of a vertical row of double-throw switches in the centre of the central panel. Thrown one way these switches separately connect their respective motors to the back clips of each corresponding elevator dynamo switch; thrown the other way they connect with a pair of common bus bars which are also tapped to the forward clips of all the elevator generator switches and also to the blades of another switch by which they may be connected to either the light or the power buses. Under normal conditions each elevator is connected to its respective dynamo, but should it be desired any one elevator generator may be connected by means of the multipling bus to any one elevator motor armature. It is obviously possible to connect more than one motor or dynamo to the bus, but this makes an inoperative combination, as each motor must have a separate dynamo whose field is controlled to give the variable voltage desired. It is also possible to use any of the elevator generators by means of this bus for lighting or other purposes, but the lighting and power dynamos cannot be used on elevator service, as their fields are con-

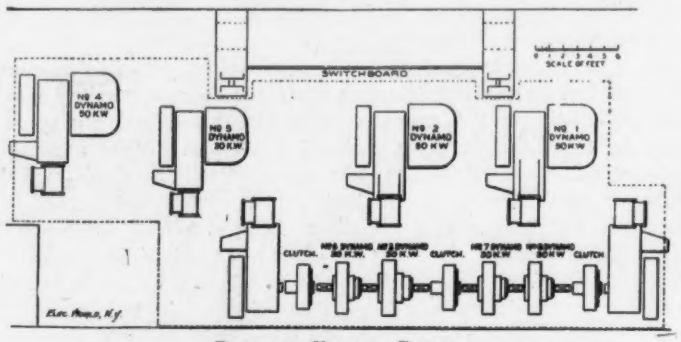


Passenger Elevator Machines.
Lighting and Power Dynamos.

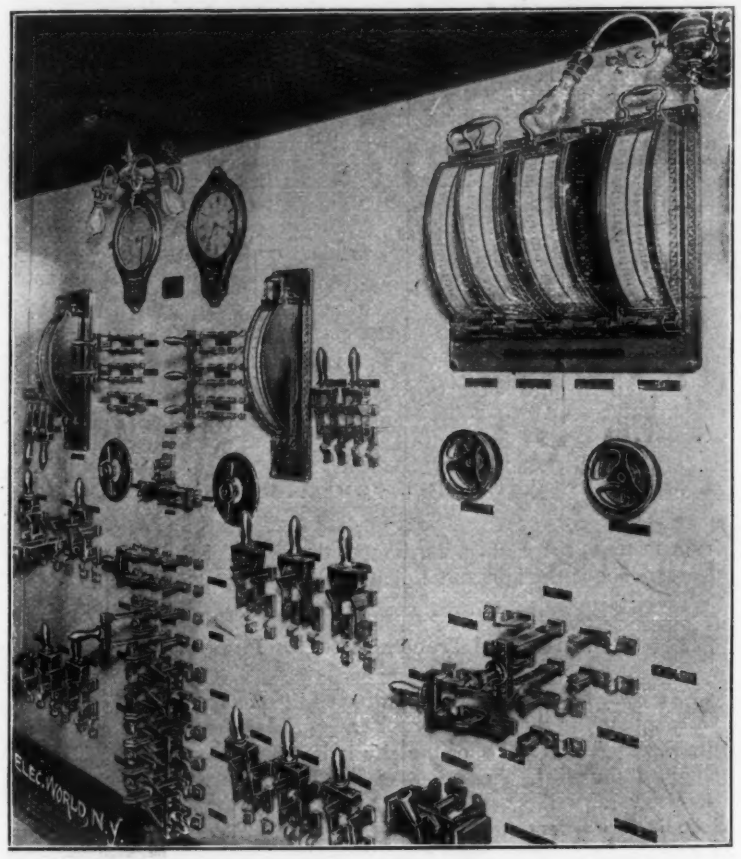
Control Mechanism on Machine.
Elevator Generators.

trolled only from the switchboard. Inasmuch as it is planned to throw any elevator motor armature onto any elevator dynamo, it is also essential that the field of that particular dynamo should be connected to the rheostat in the car operated by that motor. For this purpose a set of four double-pole, double-throw switches is located at the top of the central panel, with multiple bus-bar connections similar to those of the main switches corresponding.

For equalizing the series fields of the compound-wound lighting machines a bus is connected to a single-pole switch located adjacent to each circuit breaker. A three-wire street service breakdown connection for the lighting plant is also provided, consisting of a large triple-pole, double-throw switch located behind the board. One of



Plan of Engine Room.



Central Panel and Part of One Dynamo Panel of Switchboard.

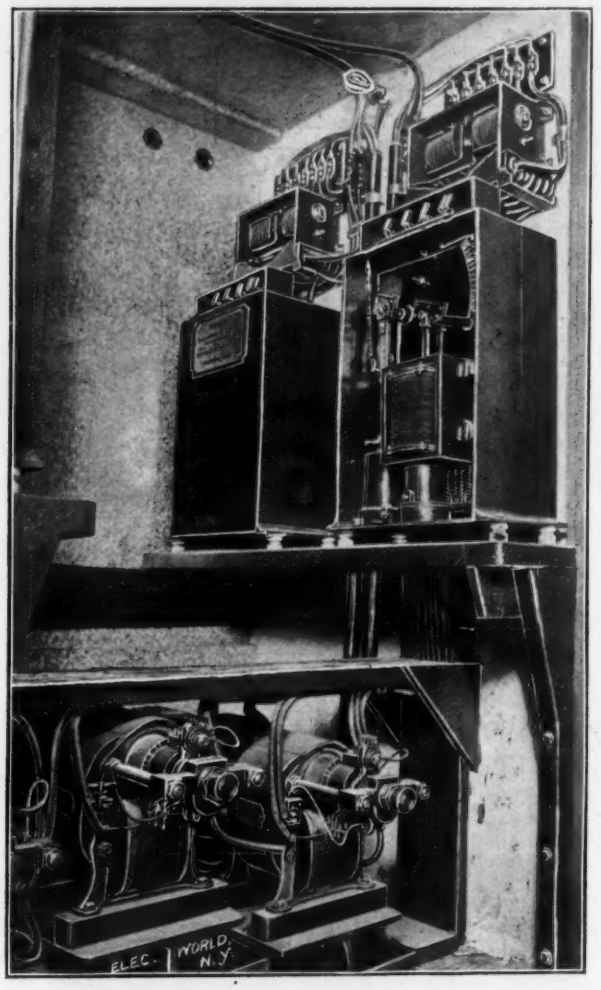
the lighting buses is cut and brought to the two outside switch blades, these being multipled on one polarity when running on the isolated plant.

About eighteen feeders run from the board, all of which are provided with an iron armored tube to each wire. All panel boxes are of marbleized slate with outer wire gutter, and the panel board has each circuit controlled by a separate knife switch and double-pole fuse. Porcelain covered bugs are used to connect all fixtures to the branch circuits. About 3000 16-cp incandescent lamps are connected.

The elevator machines are of the double interlocking worm gear type with single drum, manufactured by Otis Brothers & Co., and equipped with 30-hp Otis motors. Two of these machines operate the main passenger cages; the other two are used for freight and for the employees. The machines are located in an enlarged section of the forced draught duct, thus giving them unsurpassed ventilation.

For the excitation of the elevator motor fields current is taken from the light and power circuit. The supply wires, field terminals and other conductors connected to the brake and slow motion switch are carried to the car controllers in flexible cables. The car controller is placed beneath the car floor and is operated by a handwheel and sprocket chain. It is arranged to reverse the connection of the field winding of the elevator generator and also to vary the resistance in circuit with it. In this manner the polarity of the field in the generator is reversed and its strength varied, consequently changing and varying the current generated in the armature. Other contacts in this controller connect with the relay for operating the electromagnetic brake on the motor shaft. A rheostatic switch is driven by the machine gears to automatically limit the travel of the car in either direction.

The various safeties include a speed governor switch at the top of the shaft, a slack cable switch attached to the machine and a car safety switch on the car to be manually operated. Any one of these, when operated, opens the exciting current supply line and causes the brake relay to open the brake magnet circuit, applying the brake. A stationary operating switch is also placed adjacent to the motor so that the machine may be controlled from that point. It is arranged to throw a resistance in circuit with the generator fields and connect them across the line so as to give the motor a slow motion and bring the car down only. A more complete description of the mechanical details of the elevator machine appeared in issues of The Electrical World dated May 22 and 29, 1897.



Dumb-Waiter Machines and Controllers.

A smaller but by no means unimportant part of the elevator equipment of this institution consists of three dumb waiters furnished by the Elektron Manufacturing Company. They are driven by small 1-hp bipolar Elektron motors worm-geared to grooved grip sheaves around which run the endless cables attached to the small wooden cars. At several floors each waiter is provided with up and down starting push buttons and a dial which can be set to stop the waiter at any floor desired. The control circuits connected with the segments of these dials corresponding to the various floors are respectively connected to switches in the shaft at suitable points to be oper-

ated by the moving car. These controlling circuits connect with a magnetically operated switch which supplies the current to the motor armature through a resistance cut out by a rheostat arm controlled by a solenoid in shunt connection. In operating these hoists the dial pointer is set to connect the control circuit through the shaft switch at the floor at which the car is to be stopped. The up or down button is then pushed, actuating the proper coil of the automatic switch which starts the motor. When the car reaches the floor indicated on the controller the shaft switch is operated and the controller circuit is opened, consequently de-energizing the coil of the automatic switch, cutting the current off from the motor and stopping the car. The operation is similar in either direction.

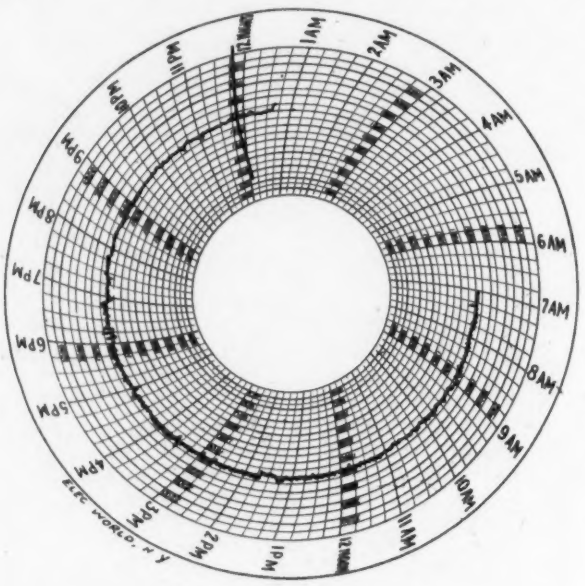
Other motors are also in use to drive the laundry machinery, ventilating apparatus and some pumping apparatus.

Iron armored conduits have been placed for messenger, ticker, private telephone and bell systems. Adjacent to the dumb waiter hoists is a complete call bell system for signaling from any floor to any other. An intercommunicating telephone system connects the superintendent with all of the various departments, and a private central office telephone system with about eighty stations throughout the building centres in a switchboard near the office on the ground floor.

The electrical engineers in charge of this work were Messrs. Pattison Brothers, the contractor for the electric light and power installation being Mr. C. L. Eidlitz.

Recording Voltmeters as Seismographs.

The earthquake shock felt in San Francisco, Cal., at midnight of March 30 was recorded on a Bristol recording voltmeter used in the electric power station annex of the Claus Spreckels Building, in San



Earthquake Record.

Francisco. The record sheet of that day is reproduced herewith and shows the extreme swing of the needle at about ten minutes before twelve midnight, this being within the limits of error of the clock mechanism the time of the shock. The tremor was quite severe in the engine room, but no perceptible damage was caused to any of the machinery therein.

The Diffusion of Light by Holophane Globes.

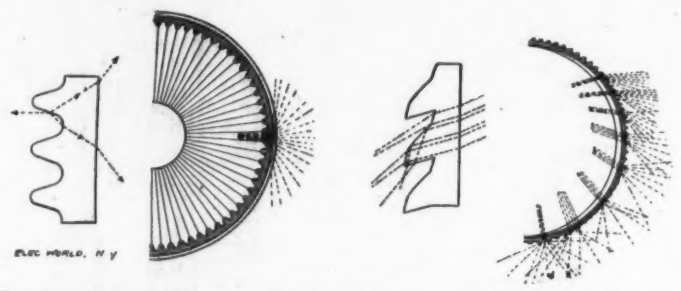
The Committee on Science and the Arts of the Franklin Institute has recommended the award of the John Scott Legacy Medal and Premium to Messrs. Blondel and Psaroudaki for their invention of holophane globes. From the report of this committee the following statements have been abstracted:

The object of the device is to secure diffusion of the light as well as an improved distribution, such that the light usually sent off above the horizon shall be deflected downward to points where it is more needed. These results are sought by the use of reflection and refraction, and to avoid so far as possible absorption and consequent dead loss of light the globes are made transparent.

The interior surface, as shown in the accompanying horizontal cross section, is made up of a continuous series of vertical meridian flutings, their function being to break up the rays of light impinging upon them and distribute them horizontally in such a way that each fluting distributes the rays through approximately 180°, and therefore the eye in looking at the globe shall see rays from each such fluting instead of from one central point within. The exterior surface is made up of grooves arranged in parallels in horizontal planes extending completely around the globe and with faces beveled at angles depending upon what might be called their latitude, in such a way as to increase the downward flow of the light.

Upon examining the distribution of light by this globe, the investigating committee found that when the light from an arc lamp passed through the globe the effect upon a vertical screen showed a distinct reduction of the amount of light passing through the upper part of the globe and a definite increase of the light in a horizontal plane and at all angles below that plane, the space vertically beneath the globe being well illuminated. The fact that diffusion is secured was shown by the character of the shadows cast. When an opaque body was held near the globe there was practically no shadow on the screen a few feet away. As the body was moved toward the screen a faint shadow having very indistinct outlines was thrown upon it. This property of the globe has the effect of entirely doing away with the objectionable shadows of near bodies thrown by arc lights. In appearance the holophane is covered with bright points over its entire surface. Each of these points is a source of light, since each intersection of the internal meridian and external parallel sends out rays fairly uniformly distributed. As the number of these brilliant points is very great, covering the entire globe, the light coming from its surface is well diffused.

Tests made with holophanes on Welsbach gas burners showed a total loss by absorption of about 8 per cent. to 10 per cent. and an increase in the mean candle power below the horizontal plane of



Horizontal and Vertical Half-Sections, with Enlarged Details.

from 17 to 29 per cent., according to the shape of the globe, with a decrease above the horizontal plane of from 28 to 42 per cent.

Electrical Transmission for Pumping.

The level of the greater part of the city of New Orleans, La., is so low that the removal of water falling in heavy rains is a serious problem. A large part of the city is below the level of the Mississippi and but little above that of Lake Pontchartrain, and at times of heavy rains the gradient is so slight that the flow towards the lake is insufficient to carry off the water. Pumping stations are, therefore, to be provided by the Drainage Commission, and, to obtain high economy, power will be generated at one central point favorably located and electrically transmitted to the pumps. The generators will be of the high pressure multiphase type generating 3000 volts direct, which will be carried on multiphase lines to the pumping stations. Several motors will be installed at each station, so that the flow can be economically controlled to correspond with the demand. The motors will rotate in a horizontal plane, being direct coupled to vertical shafts, on the lower ends of which will be helical propellers, this arrangement being possible on account of the low lift varying from 3 to 10 feet and the large amount of water to be raised.

Electric Power in the Russian Navy.

It is stated that electric power is about to be introduced for the purposes of raising ammunition and loading and working the guns on all the ships of the Russian navy.

Locking and Unlocking Devices on Party Telephone Lines.

BY H. S. WEBB.

In an interesting article on "The Past Year's Advance in the Art of Telephony" in THE ELECTRICAL WORLD of January 1, 1898, Mr. Kempster B. Miller describes, in general, the party line selective system of Messrs. Barrett, Whittemore and Craft. The same patent also describes fully that part of the mechanism used for locking all the telephone switches except the one called up by the exchange operator, and then for unlocking them all when the line is free. This part of the system is as completely worked out and as ingenious as the rest of the system.

Fig. 1 gives the diagram of the system when there are six subscribers on a pair of lines. In this system the telephone operator by pressing one key locks all the telephones but the one desired, thus preventing any of the other five subscribers from coming in on the line when it is already in use, which, if possible, would disturb those already talking besides allowing their conversation to be overheard by the third party. To furnish this device only six subscribers are put on one pair of wires and the other two combinations of currents, namely, positive and negative currents, over both the *A* and *B* lines in parallel, the earth forming the common return, are used to work the locking and unlocking devices. This leaves a positive current over *A* to call subscriber No. 1, negative over *A* to call subscriber No. 2, positive over *B* for No. 3, negative over *B* for No. 4, positive over *A* and negative over *B* for No. 5, negative over *A* and positive over *B* for No. 6. In the last two combinations the lines *A* and *B* are in series and the earth return is not used. If it is remembered that currents of proper direction only will close the polarized relays, but a current in either direction will open the neutral relays, it will then be clear that positive or negative currents over both lines *A* and *B* will not call up subscribers Nos. 1, 2, 3 or 4 because the neutral relays will open. Nor will subscribers Nos. 5 or 6 be called up by locking or unlocking currents because they each have two polarized relays requiring a positive current over *A* and negative over *B* or vice versa. A current in the wrong direction will leave them open.

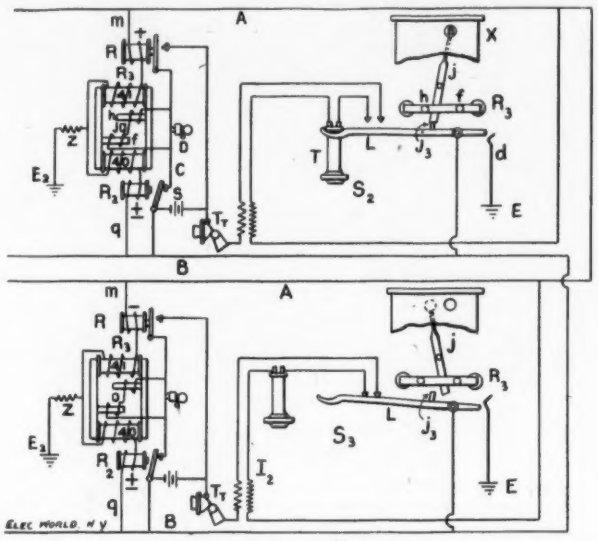


FIG. 2.

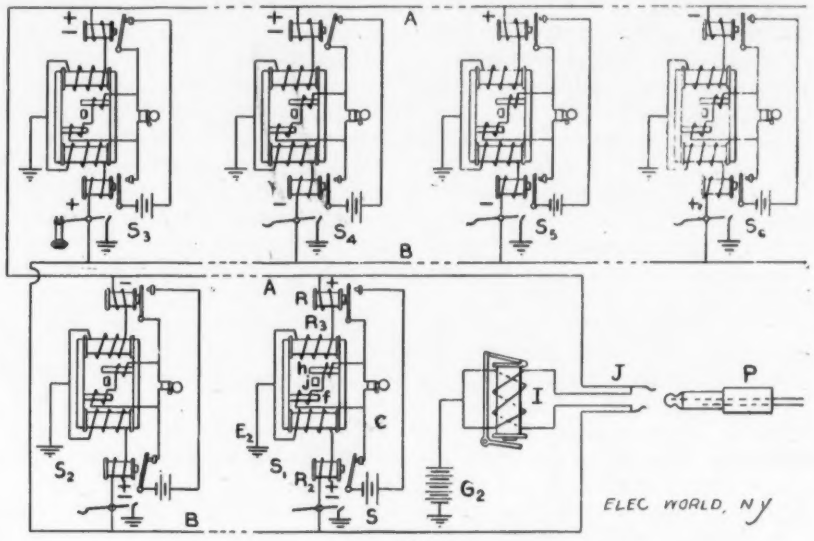


FIG. 1.

In Fig. 2 will be found the scheme used in each subscriber's instrument for locking and unlocking.

R and R_2 are the same relays as shown in Fig. 1. The upper half shows instrument for subscriber which requires only a positive current over *A* to ring its bell. R_3 is a closed iron magnetic circuit. Over the limb 41 is wound the wire from *R* and over 40 is wound the wire from R_2 in such a direction that the flux set up in the iron by any combination of currents through 40 and 41 used to call up any of the six stations will be in the same direction through the iron yokes connecting 40 and 41. *f* and *h* are soft iron projections, as shown, with a polarized steel armature *j* between them. *f* and *h* are wound with coils which are shunted around the bell *D*. Before any current can flow through these coils both relay contacts *R* and R_2 must be closed, *i. e.*, when this subscriber is called up, his bell will ring and a current will, at the same time, flow through the coils on *f* and *h*.

Now, in the normal state, practically no flux will flow through the high reluctance circuit 40 *h j f* 40 or through 41 *f j h* 41 when it can pass through the closed iron circuits, whose reluctance, since it contains no air gap, is much less, and thus the polarized armature *j* will be unaffected, because the magnetic poles at *f* and *h* are too weak. This will be the normal condition for all stations. Suppose the operator desires to call S_3, a positive current is first sent over both lines *A* and *B* in parallel by pressing the proper key at the central station. This current, passing through 40 and 41 in parallel and returning through the ground, sets up an opposing flux in the yokes, thus causing the lines of force to complete their circuit through *h j f*, moving the polarized armature *j* in such a way as to lock all the instruments, *i. e.*, by means of the lug J_3 it prevents the hook switch from moving up, even though the receiver be removed, and, at the same time, displays through a hole in the telephone box a busy signal, showing the subscriber that the line is in use and that he will have to wait until a clear signal is shown before he can use his telephone. The lever will remain in its locked position until a proper current causes it to be unlocked. The operator now presses the proper key to call up S_3, say; *i. e.*, a negative current only is sent over line *A*. Both relays being closed, the bell rings and, at the same time, a current flows through the coils on *h* and *f* in such a direction as to move the armature *j* to its unlocked position. All stations except S_3 will evidently remain locked, since their coils on *h* and *f* have no current passing through them. Thus only the subscriber called can connect his telephone to the line by removing the receiver. When the conversation is ended, the oprato unlocks all stations by negative currents over both *A* and *B* in parallel. This moves the polarized armature *j* to its unlocked position and the signal to the clear position. The locked and unlocked positions of *j* are shown at S_2 and S_3, respectively. When the line is not engaged, all that a subscriber has to do to call up the central is to remove the receiver from the hook. As the rear end of the hook moves down it momentally touches the rear contact *d*, thus completing the connection from ground at subscriber's station through line *B*, one-half of the annunciator *I*, the generator G_2 and ground at the central station, thus dropping the annunciator shutter. This connection from line *B* to ground through *d* has a much lower resistance than the other path to ground through R_2 40 *Z E*, thus allowing a sufficiently large current to flow for a short time.

There is, normally, a negative current flowing through both halves of the annunciator, but in such a direction as not to energize it, and also through the apparatus R_3 tending to unlock all the levers, and hence it does not disturb the normal position of the armature *J*.

At the central station are eight separate keys, one for each of six subscribers, one for locking and one for unlocking the instruments. These party line sets probably complicate matters somewhat at the exchanges, but this is more than offset by the saving effected in having six practically independent subscribers on one pair of lines.

S. W. Whittemore has recently received another patent, No. 596,036, by means of which he does away with the polarized magnetic device R_3, replacing it with an electromagnet similar to the self-restoring annunciators used on the bridging switchboard systems. In this arrangement no separate signal key is needed for locking, but

one is used for unlocking. This arrangement simplifies the apparatus somewhat.

While this system may seem somewhat complicated, it must be remembered that no magneto-generator is required at the subscribed station, and the usual polarized bell is replaced by a simpler vibrator bell.

The John Street Exchange of the New York Telephone Company.

The New York Telephone Company has recently put in service a new exchange on Gold Street, near John Street, known as the John Street Exchange. All stations within the section bounded by William Street, Frankfort Street, Dover Street, the East River, Wall Street, Pearl Street and John Street, and previously connected with the Cortlandt Street Exchange, have been changed over onto the new switchboard. The exchange is quartered in a new building, built by the company, about 75 feet square and eight stories in height, and of the most modern and up-to-date steel fireproof construction. The whole of this will be occupied by the various departments of the telephone company, some of which were crowded into temporary quarters by the tearing down of the old building on Dey Street for the handsome new office building recently constructed by the company. The construction, maintenance and engineering departments will be provided with offices, drafting rooms and experimental laboratories. The supply department occupies the ground floor and the repair shop has two entire floors, well equipped with machine and other tools. The switchboard and operators' rooms, or telephone exchange proper, are on the top floor.

The building is completely equipped with an isolated electric plant, consisting of two Ball & Wood horizontal high speed engines, with Western Electric 500-ampere 125-volt generators mounted on the crank shafts, also a smaller unit made by the same concerns, and capable of generating 250 amperes. Two Elektron worm gear machines operate the freight and passenger elevators, respectively.

Forty-eight ducts for the telephone cables enter the basement of the building through 3-inch wrought iron pipes. These pipes run up the building, concealed in one wall, forming a sort of vertical subway, to the sixth floor, where the lead-covered cables terminate in neat pot-heads, from which run the interior rubber-covered cables to the distributing frames on the floor above. On these distributing frames the incoming cables are fanned out on horizontal rows or terminals on one side of the frame and cross-connected through the open steel structure to the vertical rows of protecting terminals on the other side, to which the switchboard cables are connected. These latter terminals are arranged for the usual protective devices, namely, carbon plates to take the lightning and heat coils to cut off the sneak currents, but in this board the carbon plates are replaced by wooden plugs and the heat coils by brass pins. All the circuits from this exchange run to the subscribers' premises underground, and are so carefully installed that it is considered that it will probably be unnecessary to provide them with protecting devices, the elimination of the latter reducing somewhat the frequency of faults and troubles. The substitution of wood and brass dummies, however, is only tentative, and if the trouble is increased by this arrangement proper protective devices can readily be inserted.

At present there is installed in the exchange room a temporary switchboard of horseshoe shape and capable of accommodating about 1200 subscribers' circuits. There are six incoming trunk positions and sixteen subscriber operator positions, the board being of what is known as the divided type, that is, the subscribers' lines are not multipled through the answering operators' positions, and local connections are completed at the incoming trunk sections in the same way as connections from other exchanges. Although this is an arrangement well known in the telephone industry, a brief explanation of the method of operation may be of interest to those not specially versed in telephone work.

Each operator has before her only the jacks and drops of her own subscribers, and is not, as in the multiple boards, within reach of the spring jacks of all the subscribers on the board. Any call coming to her for a local number other than one of the few among her own particular subscribers must be made by a connection through a trunk line terminating before an operator at one of the incoming trunk sections. On receiving a local call from a subscriber the answering operator speaks to the trunk line operator over a call wire and asks him to assign her a trunk, which he does, and she immediately connects the calling subscriber to the trunk assigned, which the trunk operator in turn connects to the multiple jack of the subscriber wanted. A call for a subscriber in any other exchange is treated in exactly the same manner, the only difference being that the trunk operator who completes the connection is in a distant exchange instead of being at another part of the same switchboard. Calls for long distance wires are completed in the reverse manner. Long distance central is called up over a special line and told what wire is wanted and the number of the line calling. "Long distance," when the distant party has been secured, calls back over an incoming trunk for the station calling, the call then being treated as an incoming trunk connection. There are therefore no outgoing trunks from such an exchange to "long distance."

As a rule all the trunk lines between the exchanges are divided into two classes, one for calling in one direction and the other for calling in the other direction, thus each station has its separate outgoing and incoming trunks. In case of small stations, however, suitable calling and indicating apparatus is fitted at both ends, so that any such trunks can be used in either direction.

Visual disconnecting signals, consisting of miniature lamps, are used in this board on trunk lines to all exchanges suitably fitted therefor, the lamps being fed by small Crocker-Wheeler motor-generators through banks of resistance lamps fitted with suitable relays and retardation coils. These lamps automatically signal to the incoming trunk operators that the trunk has been disconnected at the distant exchange. They are a great aid to rapidity and accuracy of working.

The main switchboard is of the horseshoe shape, with the chief operator's desk at its approximate centre. The arrangement of the board, as stated above, is only temporary, space being left around outside it for a permanent board, also horseshoe shaped. This permanent board, though not as yet determined, will probably be of the common battery type for about 4000 lines, with all the latest improvements, and others that are still under consideration.

The management of the new exchange is interesting, as it represents the latest development in this feature, so important in large systems. The exchange manager is, of course, at the head. Under him is the official known as the chief operator, whose responsibility has been greatly increased over that of corresponding officers of former years. She is practically the executive of the staff of operators, and under her is an assistant and the supervising operators, each of which has in charge a division of the board with its operators and reliefs.

The arrangements for the physical comfort of the operators are most complete. A pleasant sitting room with easy chairs, papers, magazines, etc., and looking out over the East River and Brooklyn Bridge, is provided, as well as a lunch room, a kitchen in which coffee, tea, etc., are provided by the company, and a hospital. The cloak rooms are provided with a new type of steel netting lockers, one of which is provided with lock and keys for each two operators.

The exchange was first put into service on the afternoon of Saturday, April 2, and is now carrying 206 flat rate stations, 479 message stations and twenty-six pay stations, with a total of 731 lines in service, reaching 815 stations. The board was cut in in less than one-half hour's time, with no interruption whatever to the service. This was done by gradually connecting up the lines to the new switchboard in multiple with the old board at Cortlandt Street and finally changing over by simply cutting out the connections to the old board. Transfer tables giving the old numbers and new numbers of the lines cut over were distributed to all the operators in or near Greater New York, so that on making any call to Cortlandt Street, if it was answered as "discontinued," the calling operator had simply to look at her transfer table to see if the line had been removed to the new exchange.

The work reflects no small amount of credit on the engineering and construction departments, as the laying of over 7 miles of underground cable and the installation of all the apparatus had to be done in less than six weeks' time, and without interrupting the continuity of the service. The temporary switchboard will be retained after the permanent board has replaced it, for use as an emergency board in any exchange where it may be necessary to provide quickly a new equipment.

The New York Telephone Company now has thirteen exchanges in old or lesser New York, eleven of these being on Manhattan Island. The Cortlandt Exchange, from which this new division was removed, was quite overloaded, having between 5000 and 6000 subscribers, a number greater than desirable with the latest methods of working.

Thanks for the information embodied above are due to Mr. Herbert Laws Webb, Mr. J. Tilley, of the engineering department, and Mr. D. D. Field, the manager of the new exchange.

The Regulation and Protection of the Electric Motor.*

BY HARRY H. CUTLER.

Electric transmission of power is fast becoming recognized as capable of almost universal application to all kinds of machinery. Scarcely a meeting of manufacturers, trade associations or engineering societies takes place where something of a favorable nature is not said about this rapidly growing and important industry. It can be truthfully stated, however, that the public is only just beginning to recognize the adaptability of the electric motor, and that an enormous demand awaits it in the near future.

The introduction of the electric motor into general use has not been as rapid as is generally supposed. It has been known for at least seventeen years, and undoubtedly a great deal longer, that transmitting power by means of belts and shafting was uneconomical, and a remedy was pointed out at that time which is just being recognized as good practice, and nine-tenths of our mills and factories are still wasting enormous amounts of money by clinging to this antiquated practice of belt transmission. This is what is meant by the assertion that an enormous demand for the electric motor is yet to come.

With each different application of the electric motor a connecting link between the power and what it is to drive must be provided which shall be adapted tor the peculiar kind of work to be performed. This link is the rheostat or controller, and the rapidly growing demand for these devices has given rise to what could almost be called the profession of rheostat engineering.

The same motor which drives a pump would drive a fan, a printing press, or a line of shafting, but the proper type of rheostat to use for these various cases would be vastly different in each case.

By far the largest number of stationary motors in use to-day are direct current, plain shunt wound, non-reversing and running at a constant speed. These motors are usually provided with motor starting rheostats, whose resistance is in circuit only during the few seconds consumed in starting the motor. Simple as these rheostats are, care should be taken in selecting the size and style best suited for the work.

A motor that is started and stopped but two or three times a day can be satisfactorily handled with a starting rheostat that would frequently be useless for starting and stopping a motor two or three times a minute. A rheostat arranged to start a motor under full load to the best advantage will not start a motor equally as well at 100 per cent. overload. A rheostat satisfactory to the fire underwriters of Chicago is not necessarily adaptable to the New York authorities, and would be looked upon as unnecessary extravagance by the country trade. It is important then even in the very simplest cases that the character of the work should influence the selection of the proper starter or rheostat, and when it comes to applying a motor to almost any other use than that of driving through belts and shafting this question becomes of still greater importance. Most stationary motors are operated at constant speed, but consumers of power are finding out that the speed of a motor can easily be regulated at will, and are calling for appliances which will accomplish this.

There is practically but one way by which the speed of a shunt-wound motor or a constant-potential circuit can be changed, and that is by changing the voltage across some of its parts or windings. There are a great many ways to accomplish this. The simplest, but unfortunately the most unsatisfactory, is to reduce the voltage across the armature by inserting external resistance in series with it. This method is not only uneconomical on account of the power wasted in the rheostat, but also destroys the regulating property of the constant-speed motor. An increase in the load when external resistance is in series with the armature may actually stop the motor entirely.

Another method of changing the voltage across the armature is to operate the motor on a multiple-wire constant-potential system, connecting the armature across various pairs of wires for various speeds. This method wastes no current, and causes the motor to run at definite speeds independent of the load. Another similar method is to connect the armature across a variable number of storage batteries, thus obtaining any desired speed over a wide range. Still another consists in so winding the armature that the coils may be changed from parallel to series, which can be accomplished in several ways.

Altering the voltage across the field of a motor also affects its speed, but in exactly the opposite way from that caused by changing the voltage across the armature. The insertion of resistance in the field circuit is not only simple and inexpensive, but, unlike the armature regulation through resistance, it wastes comparatively nothing in heat and allows the motor to maintain its speed independent of the load. Nearly all of the large builders now make motors which will operate satisfactorily with a field variation of 50 per cent. in ampere turns.

A similar result is frequently obtained by using a compound-wound motor, winding the series fields in separate sections and cutting out these sections successively by means of a special switch. At least one manufacturer goes so far as to use so many of these field sections that their resistance is sufficient to prevent more than the proper amount of current from flowing on closing the circuit, without using any external resistance whatever. A very powerful starting torque and a wide range of speed is thus obtained, but the method will not regulate the speed independent of the load. It is applicable therefore chiefly to cases where an attendant is constantly on hand, as in the case of elevators, cranes and hoists.

One more method of varying the field strength consists in throwing the windings of the field cores into series connection for high speed and series multiple for slow speed.

Motors are sometimes regulated by means of a separate generator for the armature of each motor, varying the voltage of the generator by means of its field rheostat. This method is known as the Leonard system, and gives perfect regulation over a wide range, without wasteful resistances.

In the use of so-called compound-speed regulators used for fan or ventilating motors, the motors are so arranged that when operating at normal speed no external resistance of any kind is in circuit. To reduce the speed resistance is cut into the armature circuit, and to increase the speed external resistance is cut into the shunt-field circuit.

To select the proper sized motor and to determine upon the proper speed to run the fan requires an accurate knowledge of and experience with fans, air ducts and the laws of moving air. This is a subject which has not been reduced to a science by fan builders. Some builders always use a series-wound motor for driving fans and others have adopted the shunt-wound motor. When it is not necessary to vary the speed of a fan, the series motor is probably preferable as being simpler, but for driving large fans, where speed regulation is always desirable, the use of a plain shunt-wound motor and a compound-wound regulator appears to be the best practice.

In determining the resistance of a fan regulating rheostat it must be remembered that the power required varies as the third power of the speed, and not directly as the speed, as in driving shafting and machine tools. A regulating rheostat for a fan is therefore designed on entirely different lines; even the contracts and mechanism are different, because a fan is never started and stopped at frequent intervals during the day, and a cheap button front will do the work satisfactorily.

Diametrically opposed to the fan regulator is the electric elevator controller. This work calls for continually starting and stopping many times a minute all day long; heavy renewable contacts are absolutely necessary, as well as a special type of motor, and problems of a peculiar character are met with.

There are in use many methods of operating electrical elevators. Among those in most common use is the system comprising a compound-wound motor, started through external resistance and the windings of the series coils themselves. This resistance is then cut out in several steps under control of some kind of a governor; the series-field coils are then cut out and finally the shunt field is weakened by the insertion of external resistance.

Elevator motors require reversing and consequently the opening of their circuits. Whenever an inductive circuit carrying current is suddenly opened a voltage much higher than that of the original supply may be set up. This not only burns the switches, but is liable to puncture the insulation of the motor, sooner or later, unless means are taken to prevent it. Many designs of elevator controllers and rheostats on the market try to overcome sparking by opening the circuit with a snap switch, but the strain on the insulation of the motor is only increased the more, and all that is gained is that the switch does not burn up so quickly. A snap switch is well enough for use in a lighting circuit, but when used in connection with a reversible motor it is a constant menace to the safety of its insulation.

When an elevator is coming down with a heavy load the motor has no work to do and consequently has a tendency to run away, being driven by the weight of the elevator. If the motor is shunt wound and its field kept at constant strength, the load on the ele-

* Abstract of paper read before the Chicago Electrical Association, April 1, 1898.

vator will tend to drive the motor so much above its normal speed that it becomes a generator and returns current to the line. In case of the plain shunt-wound motor this is not a dangerous speed. But plain shunt motors are now seldom used for elevators; almost all builders of elevators use compound-wound motors, or at least shunt motors whose field is weakened after starting.

Controllers which bring the elevator to full speed by inserting resistance in the shunt field run much faster when driven by a heavy load on the elevator, and it is necessary for the attendant to check the speed by moving the lever back and thus strengthening the field. Should the attendant move the lever so far back that external resistance is inserted into the armature circuit the speed of the elevator would be increased instead of decreased, due to the fact that the motor, acting as a generator, has to run faster to deliver the power given to it by the car through the resistance to the line.

THE PROTECTION OF MOTORS.

Motors can only become dangerously hot by abnormal currents being allowed to flow for an appreciable length of time. A current of double or trebie that of the continuous safe carrying capacity of the motor will not do the slightest harm, unless allowed to flow long enough to overheat the motor. When such abnormal currents last only a few seconds it is neither necessary nor desirable for the protecting device to operate, and a properly designed protector should not operate unless the temporary abnormal currents exceed this amount, or last long enough to overheat the motor. Since it is the heating effect of the current which causes an overloaded motor to burn out, the most natural protection would be a device that operates through the influence of this same heating effect of the current. The well-known fuse was therefore recommended for this work and the electrical trade accepted it without question. As motors came into more general use it began slowly to dawn upon the electrical profession that they were being misled in their implicit faith in the fusible cut outs offered by the trade. Too many motors supposed to be protected by fuses burn out, and experiments show that the ordinary commercial fuse will blow at almost any amount of current or not at all, just as it happens to feel at the time.

Not enough significance appears to have been given to the cooling effect of the ever varying drafts of air to which the ordinary commercial fuse is exposed, and therefore to expect any exposed fuse, no matter how long, to blow at a certain predetermined amount of current appears to the writer to be little short of an absurdity.

The magnetic circuit breaker recognizes nothing but current strength, and takes no account of whether the motor is hot or cold. The burning out of a motor is due to the cumulative heating effect of the current, and is therefore largely dependent on the time during which it flows. It should be noticed, however, that excessive abnormal currents cause instant damage to the commutator of a motor, if not to the armature itself, and should be cut down as quickly as possible. This latter office the ordinary commercial circuit breaker will generally perform satisfactorily. It becomes a nuisance, however, by opening the circuit and interrupting the service at every little temporary abnormal fluctuation of current, which current does not cause the slightest harm and calls for no protection. No ideal protection exists to-day to my knowledge.

To protect a motor from heat it is evident that the heating effect of the current should be utilized in the protective device. This is accomplished in at least two devices now on the market, namely, the inclosed fuse and a peculiar make of circuit breaker designed by the writer. The inclosed fuse shown is of the D. & W. make, and the fibre case has been removed in order to show its construction more clearly. The distinguishing feature of this fuse is the enclosed air chamber, around the fuse proper, consisting of a gelatine capsule, similar to those used by apothecaries for filling with quinine and other medicines.

The fuse proper is very short and is contained entirely within the capsule; copper wire leads are connected to the fuse and lead out to the terminal caps through closely packed sand or plaster of paris. The capsule provides a definite amount of air within which the explosion takes place, thus greatly increasing the accuracy of blowing at predetermined currents. The force of the explosion is taken up by the layers of sand on each end and as there is no air and but little metal to feed the arc, it immediately goes out. These fuses are surprisingly accurate, and, being absolutely sparkless, certainly appear to be an ideal protection both for the motor and against fire. They are ahead of the times, however, and the vast majority of those who operate motors still cling to the old bare fuse.

The action of the circuit breaker mentioned depends upon the combined magnetic and heating effect of the current. Its mechanical construction is similar to that of the usual type, the chief difference being that the magnet or solenoid used to release the trip or catch carries only a portion of the current passing through the breaker. The rest of the current is shunted around the active coil, the shunt being composed of material whose resistance increases very rapidly as it becomes heated. On starting a motor under load both motor and circuit breaker are cold; the resistance therefore of the shunt on the circuit breaker is at its lowest point and it carries then the largest part of the current flowing through the breaker; as this current continues to flow the shunt heats up, its resistance increases, and more current passes through the magnet or active coil, which will finally act should an abnormal current last long enough to become dangerous. It is also evident that an extremely abnormal current or a short circuit would not wait for the heating effect of the current, but would cause the breaker to open instantly.

In practice these breakers are generally so proportioned as to allow an excess current of 50 per cent. to flow for a second. Any current over 60 per cent. greater than the constant current which would finally open the circuit breaker will do so instantly.

A modification of the circuit breaker is the so-called overload attachment to motor starting boxes provided with magnetic release. All the makes of this type of motor starter use an electromagnet for retaining a switch or rheostat lever in the closed circuit position. This retaining magnet is wound to be connected in series with the shunt field, in series with the armature, across the lines or in series with an external resistance across the lines. The overload magnet, which acts as a relay controlling the retaining magnets, is invariably connected in series with the armature and carries usually the entire current supplied to the motor. When the current becomes excessive it attracts its armature and demagnetizes the main or retaining magnet by short circuiting or opening the circuit of its windings.

A surprising degree of accuracy and reliability can be obtained in this way of protecting a motor from overloads. The system has, however, one chronic fault, which appears to have been entirely overlooked, and that is, that no device constructed on the above principle can possibly act quickly enough to protect a motor against extremely abnormal currents, short circuits or lightning, notwithstanding all circulars and advertisements to the contrary. It takes time to demagnetize a magnet, no matter whether it is short circuited or open circuited, and this time is fatal on short circuits and the motor will not be protected. We must then choose some combination of the various methods just described of protecting a motor. Such a combination, which would appear to afford adequate protection for the least money, comprises enclosed non-arcing fuses, the magnetic release, overload magnet, and double pole knife switch. The magnetic release affords ample protection from liability to damage from interrupted current. The overload magnet takes care of all ordinary overloads. The fuses are selected so as to blow on 100 per cent. overloads up to short circuits. The overload magnet can also be provided with the time limit device described above in connection with circuit breakers.

The Convention of the Canadian Electrical Association.

The Executive Committee of the Canadian Electrical Association met in Toronto on April 5 and completed arrangements for the annual convention. This will be held in Montreal on Tuesday, Wednesday and Thursday, June 28, 29 and 30. The headquarters of the association will be at the Windsor Hotel, where the business sessions and the annual banquet will be held. A number of interesting papers on the various departments of electrical work have been promised and will be announced later. Excursions will be made also to the following points of interest to electrical engineers: The new building of the Bell Telephone Company, the power houses of the street railway company, of the Lachine Rapids Hydraulic and Land Company, and of the Chambly Manufacturing Company, the works of the Royal Electric Company, and the laboratories of McGill University.

Electricity on the Manhattan Elevated.

A correspondent of "The Railroad Gazette" writes that he should not think it would be a very costly undertaking to operate the lines of the Manhattan Elevated Railroad by electricity, as the road already has a large battery at one terminal.

Zénobe Théophile Gramme.

On March 27 a banquet was given at Brussels by the International Jury of the Exposition of 1897 to commemorate the promotion of M. Gramme to the rank of a Commander of the Order of Leopold, and to honor the illustrious inventor by the presence of electricians from all parts of Europe. There is no other name of equal rank in the annals of electrical progress on the further side of the Atlantic, if material advancement of the electric arts be considered. Not renowned as a scientist of the highest class or as a theorist, M. Gramme has the happy distinction of having done more for the actual development of the technical applications of electricity than any other man now living, and perhaps than any other at all.

The history of this remarkable man is so little known and is such a romance of achievement in the face of conditions almost insuperably difficult that it is well to give a brief outline of it here. Born in a small town of Belgium in 1826, Gramme found himself, at thirty-four years of age, a sort of carpenter, engaged in making baluster rails for staircases in Paris. The "Alliance" magneto machine was going through the experimental stage in the shops of Van Malderen in that city at this time, and the proprietor of the works, himself a Belgian, engaged Gramme as a pattern maker. This was his first introduction to electricity, at that time a subject of considerable mystery even to those whose livelihood depended upon their practice of the arts connected with its application. The astonishment that the pattern maker Gramme felt at the performance of the strange machine upon which he labored was not lessened when, two years later, he was employed in the shops of Ruhmkorff to make the woodwork of electrostatic machines and induction coils. Deliberately setting to work to understand the mysteries that surrounded him, this poor artisan, whose education was so deficient that he could little more than read and write, provided himself with a text-book of physics and a dictionary (for he found the terms of his science a strange tongue) and with these for a library and the kitchen of his humble dwelling for a laboratory started to learn all that was known about electricity. To his surprise he found out that, at that day, the wisest knew but little more than himself and that some of the ideas that had possessed him, and that his fellow workmen had called visionary, were the same as those of the master minds of the subject.

His knowledge of arithmetic was limited to the four elementary rules. During a term of service as maker of gun stocks in Liége he had learned a little geometry at a night school, and this was his whole mathematical equipment. But the inventive spirit continually burned within him, and his custom was to work for a week or a fortnight at his trade, and then spend his pay and his time in experimental work until driven back to his bench by the necessity of hunger. It was under these circumstances that he elaborated the design for his continuous current dynamo machine, using a ring of iron wound with conducting wires as its armature. His struggles to obtain even the slightest recognition were pitiable. His wife and stepdaughter pawned their little belongings to help him raise the money for his experiments and his first patents, even the furniture going for the same purpose. Then, after his years of labor, he found himself anticipated by a few days in the announcement of the principle of self excitation for dynamos!

Nothing discouraged by this he went to London, where he built his first dynamo. The handiwork of the pattern maker was very visible in it, for the bed, bearings and hub of the commutator were made of varnished wood. Failure to properly insulate the high pressures developed by the machine led to its abandonment, and Gramme is next heard of in 1869, trying to raise money to exploit his ring machine. The elder Breguet, noted for his goodness, could see nothing of value in the wild dream of the inventor; but rather than send him away disconsolate he slipped into his hand a 100-franc note—enough to pay for the patent. Thus the "Gramme machine" was first made public, its inventor being then forty-three years old.

The commercial introduction of the electric light is really due to this machine, and consequently it may be said to be the starting point of the magnificent development of the electric industries. Wealth and honors flowed in upon its obscure inventor, and his name became a household word among the electricians of the world. To-day he enjoys the distinguished happiness of having been father to one of the most important of arts and of having literally worked out with his own hands the fruition of his ideas that held so great a germ of possibility.

The Electroplating of the Dome of the Philadelphia City Hall Tower.

The following account of this mammoth task in electroplating is abstracted from a paper read before the Engineers' Club of Philadelphia by Francis Schumann:

The electroplating of the shell of the tower was performed in a building especially erected for that purpose. It was 60 feet wide by 120 feet long, of heavy framework of wood, one story high, sides and roof covered with corrugated iron. A row of timber posts, supporting the middle of the roof trusses, divided the floor area into two clear spaces. The north space contained two rows of pits, three in each row, made watertight by concrete and cement sides and bottoms. The pits were of dimensions to receive the plating tanks, and of such depths that the rims of the tanks were about 18 inches above the floor level, and of sufficient width and length to leave a space of 8 inches between the outside of the tanks and walls of pits. This space was kept full of water to a level with the surface of the liquid in the tank, and thus acted as a counterpoise to prevent both the bulging of the sides of the tanks as well as to prevent leakage, the hydrostatic pressure being the same on both the inside and outside of the tanks.

Over the centre of each row of pits, and attached to the under side of the roof trusses, was a track made of 10½-inch rolled beams, carrying three trolleys and chain hoists, each of sufficient capacity to raise 3 tons. The trolleys were moved back and forth on the tracks by means of a system of ropes running over sheaves and leading to geared drums operated by hand cranks.

At the end of the rows of tanks was located the cleaning floor, having a small tank supplied with running water.

The other or south space of the floor was occupied in part by a 75-hp boiler and 50-hp steam engine, four dynamos, storage room and work benches for marking, inspecting and assembling the pieces for shipment.

The first row of plating tanks were:

1. The caustic soda tank, of plate iron, 5 feet wide, 5 feet deep and 31 feet long. The temperature of the solution was maintained at about 210° Fahr. In this the articles were immersed from two to six hours, for the purpose of removing all grease or fatty substances. From this tank each piece was taken to

2. The pickling tank, made of wood, of the same dimensions as the last, lead lined, and containing a 10 per cent. solution of sulphuric acid at a temperature of about 150°, the article being immersed from two to six hours to loosen or remove all rust, silica or other matter, the cleaning being by scraping and rubbing with wire brushes, which was done at the cleaning floor, previous to treatment in

3. The alkali copper tank, also of wood, and of the same dimensions as the last. This bath was kept at a temperature of about 150°, and was the first in which a deposit of copper or alloy of copper and tin was applied. The anodes were hung to brass conductor rods, 1¼ inches in diameter, supported on short brackets at both sides of the tank, while the cathode, or piece to be plated, was hung to a single 2-inch brass conductor rod, suspended over the middle of the tank by means of ropes and overhead sheaves balanced with counter weights. The round conductor rods were connected to flat copper conductors from the dynamos by flexible copper wire strands, to permit shifting of the round rods. The time of plating was about twenty-four hours, under 4 volts and from 1000 to 2000 amperes.

From this tank the piece was taken to the second row of tanks, the first being

4. The acid copper tank, similar in all respects to the last, except that it was lead lined and not heated, and that the conductor rods were respectively 2 and 2½ inches in diameter. At one end of the tank, in a corner, an agitator for effecting circulation of the liquid was located, consisting of an upright copper tube about 8 inches in diameter, within which a small propeller wheel secured to a vertical spindle revolved, driven from the line of shafting. The anodes were of copper, and the time of plating seventy-two hours, depositing about 11 ounces of copper per square foot of surface. The pressure was 4 volts, and the current from 1000 to 2000 amperes. The next was

5. The aluminum tank, of wood, 5 feet wide, 8 feet deep and 31 feet long. This bath was heated to about 180° by means of steam pipe coils lying at the bottom of the tank. The anodes were of aluminum alloyed with 15 per cent. of tin; the conductors were 1½ and 2 inches in diameter respectively, otherwise the details were the

same as those of the acid copper tank. The time of plating was seventy-two hours, at 4 volts and 2500 amperes. The resulting deposit of aluminum was 2½ ounces per square foot. The next and last treatment was in

6. The water tank, also of wood, of the same dimensions as the acid copper tank, and filled with clean water at about 210°, in which the article was thoroughly cleaned by immersion and a stream from a hose applied repeatedly.

Eventually, to expedite the work, two more tanks were added—one acid copper and the other aluminum. These were of plate iron, and were placed directly upon the floor in the south space near the dynamos; they were about 12 feet square and 4 feet deep; otherwise they were arranged like the larger tanks for the same purpose.

Before proceeding with the plating, the parts to be plated, after being completely fitted in place during the preliminary erection at the works, were, upon their reception in the plating department, carefully tagged with the number and location on a sheet of brass, wired to the respective part, to which it remained attached until ready to fix in place at the building.

Upon the completion of the treatment in the alkali tank, and previous to treatment in the acid copper tank, the article was carefully examined and all pinholes or other defects cleaned and filled with solder composed of tin and lead. Likewise, when the article had received its deposit of copper, it was again examined, the thick edges, which tended to form in the acid copper tank, removed by filing, and, in the event of blisters having formed, they were cut out and the piece subjected to a second treatment of copper.

The electroplating had to cover some 120,000 square feet of surface, and included pieces weighing about 10,000 pounds each. It was, therefore, slow and tedious, requiring nearly fifty months of actual time, working both day and night.

London Underground Electric Railways.

The construction of several underground railways in London is progressing rapidly. The Waterloo & City Electric line, running in twin tunnels from Waterloo Station, on the south side of the River Thames to the Mansion House, in the heart of the city of London, is all but completed, and will be opened for public traffic in a few weeks. The power plant is in position and nearly everything is ready, with the exception of the Mansion House station, at which point there is to be an underground subway providing a connection with the other similar electric lines which are being constructed. One of these other lines is the Central London Railway. It is not possible to say when this line will be finished, though workmen are engaged day and night at the tunneling and station works at various points along the route from Shepherd's Bush to the Mansion House.

The extension of the City and South London Electric Railway to Finsbury Pavement, E. C., will also meet the other lines at the Mansion House subway. The City & South London is being extended from both ends, and it is hoped that these new lines will improve the financial prospects of this celebrated undertaking. A new underground line, which is to be worked in conjunction with the City & South London, is the City & Brixton Railway. This line, like all the others, will be constructed on the Greathead principle of tunneling. In connection with this line, it may be remarked that the City & South London Company is now constructing a new tunnel under the Thames connection with the extension to Islington. The total cost of the City & Brixton line, stations, equipment, etc., is calculated at about $6,000,000. At one part the City & South London tunnels are to be widened to allow for the extra traffic which this line will produce.

Underground electric proposals are abundant in England. In addition to the numerous schemes on paper for London, there have been similar lines suggested for Brighton and Manchester, but there is not much likelihood of provincial lines going forward until the success of the London schemes now nearing completion has been assured.

One of the most perplexing problems to English railway men is how to free the metropolitan steam tunnels from the exceedingly unpleasant effects of bad ventilation. A parliamentary committee, after exhaustive investigation, declares electricity the only remedy, but the company asserts that for a dozen years or more it has been negotiating with electrical engineers, inventors and railway men, yet the difficulties cannot be overcome. The Metropolitan Company says it is prepared to close with the first feasible scheme brought forward for satisfactory electrical working in place of the present steam method, and in order to be ready it is seeking Parliamentary powers at the present time.

The Temperature Coefficient of the Thomson Recording Wattmeter.

To the Editor of The Electrical World:

Sir:—The article of Professor Hooper on the temperature coefficient of the Thomson recording wattmeter in your last issue, taken in connection with that of G. W. Donald Ricks, which appeared in The Electrical World during last September, seems to me worthy of comment. Professor Ayrton's indorsement of Mr. Ricks' work is, of course, a sufficient guarantee of its accuracy; while from personal observation during the progress of Professor Hooper's investigation I know that his work was carefully done and the results substantially accurate. We have read a great deal in the English papers of the superiority of British over American design and construction. Now what are the facts? From the articles above referred to it is quite evident that the American-built Thomson recording wattmeter is superior in design and construction to the foreign-built instrument. The Weston electrical instruments furnish another example. Even the Englishman is finding out that for the purposes for which they are intended they have no equal, and is beginning to copy; witness the "H. M. S." ammeters and voltmeters. Now as to the more general question of good engineering. It is unquestionably true that much cheap work has been installed in this country, but is this always and of necessity poor engineering? Good engineering is, I take it, skillful adaptation of means to ends. In the early days of the electric railway everything was experimental. The same may be said in regard to electric lighting. Under these circumstances elaborate and massive construction would frequently have been poor engineering. So rapid has been the advance in electric lighting that the manager of one of our oldest and largest companies recently stated that not a single machine or piece of apparatus in his principal station was five years old. Everything was comparatively new and this not because the old had worn out, but because of the introduction of new and improved types. What American engineers can do when they feel that a sufficient development has been reached and the prospective business warrants the outlay is shown in the new Edison stations, models of their kind; in the work of the Metropolitan Traction Company, of New York City, which for solid and enduring construction stands unrivaled; and in the Boston subway, the best devised and most skillfully executed scheme for urban railway traffic the world has yet seen. Finally, that our British cousins are beginning to appreciate that all American engineering is not bad is apparent from the frequent occurrence of the names of McIntosh & Seymour, Allis, Thomson-Houston and Westinghouse in connection with recent electric railway work in the United Kingdom.

Tufts College, Mass. A. E. Dolbear.

A High-Tension Switch.

To the Editor of The Electrical World:

Sir:—The notes in the issues of The Electrical World of March 5 and 19 re high-tension switch design are interesting at this time, since there is absolutely no device manufactured which gives any approach to satisfactory operation in case it is necessary to open a high-tension circuit carrying heavy current. As an example of the operation of present devices may be mentioned the fact that some months ago in Sacramento a short-circuited 11,000-volt line was opened at the switchboard, with the result that the arc burned off some overhead leads several feet above the board.

Some months ago I designed a high-tension switch (which, however, was not constructed) of the multiple break type, cylinders to be of non-arcing metal, similar to the one under discussion, but with the further addition that the first movement of the contact was a sweeping over a carbon rod of high resistance, thus largely reducing the current volume before the gaps were passed over. The combination of the initial high resistance, the cooling effect of numerous short gaps, the arc destroying properties of the non-arcing metal, and the fact that the contact would pass over one or more gaps when the current wave was near zero amplitude, should make such a switch satisfactory in operation under the most severe conditions. My design further employed a magnetic device for opening the switches, the magnets being energized by current taken from the exciters and the circuits being controlled by push buttons conveniently located in one or more parts of the power house.

Such a switch would be somewhat expensive to make, but safe devices in time of emergency are worth a little added first cost.

San Francisco, Cal. W. Stuart Smith.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

EFFICIENCY OF THE TRANSFORMER. Russell. Lond. "Elec.," March 25.—A description of a graphical method of finding the efficiencies at all loads, which is said to be very simple and to give very accurate results; by its use the labor of testing transformers is greatly simplified. He shows that the efficiency curve is compounded from a rectangular hyperbola and a straight line. The method is described and is accompanied by an analytical investigation. He remarks at the conclusion that in testing the insulation resistance of a transformer it is customary to use twice the primary E. M. F. for half an hour, the secondary being connected with the iron case or core; if no odd noises are heard, a test of five minutes is probably sufficient.

IMPROVEMENTS IN CONTINUOUS CURRENT MACHINES. Seidener. "Zeit. fuer Elek.," March 20.—A reprint of a short paper reviewing recent improvements and describing his method of compensating for the armature reaction and providing a method for compounding. The magnet frame is of the iron clad type, but the two cores are slit from the pole face to the yoke; the two diagonally opposite halves of the split cores are surrounded by the compound windings. He made a test with a two-pole machine built originally for 10 kilowatts and loaded it for many hours with 20 kilowatts, and even with 27.5 kilowatts, without diminishing the efficiency or increasing the heating or the sparking; the change however also included a toothed armature for a smooth one and the use of the Mordey chord winding.

PRACTICAL OPERATION OF MULTIPHASE CURRENTS. Hawkins. Lond. "Elec. Rev.," March 25.—The beginning of a reprint of a paper read before the Northern Society of Electrical Engineers. It seems to be a practical paper of a general character, but appears to contain nothing new; he discusses generators, motors and the like, describing the prevalent practices, especially with reference to the motors.

ALTERNATING CURRENT MOTORS. Atkinson. Lond. "Elec.," March 25.—An abstract of the paper noticed in the "Digest," March 19.

SELF-EXCITING ALTERNATORS. Boucherot. "Bul. Soe. Int. des Elec.," Feb.—The complete paper, an abstract of which was noticed in the "Digest," March 12.

POLYPHASE MOTORS. Boucherot. "Bul. Soc. Int. des Elec.," Feb.—The complete paper, an abstract of which was noticed in the "Digest," Feb. 19 and 26.

DYNAMO CONSTRUCTION.—Lond. "Elec." and "Elec. Rev.," March 25, and "Lightning," March 24.—An illustrated description of the newly erected works of Mavor & Coulson, in Glasgow.

COMMUTATORS AND BRUSH HOLDERS. Hanchett. "Street Ry. Jour.," April.—The only kind of copper suitable for commutators is drawn or forged copper; the mica should be in continuous strips and not built up; both amber and India mica are used for insulation; of these, India mica is best, electrically considered, but being harder than amber mica is not as desirable, since, if of the proper thickness, it will not wear down as rapidly as the copper, producing a rough commutator. The proper width of segments for railway motors is given as one thirty-second inch. He describes the methods of attaching commutator segments to the armature shaft, and to insulate them.

Lights and Lighting.

COMBINATION LAMP FILAMENT.—Lond. "Elec.," March 25.—A note referring to some experiments by Ayrton on lamp filaments made by the Langhans process. Eight lamps were carefully tested; the mean life up to the present is 606 hours, but as three are still burning this average will increase; the mean power consumption is 2.92 watts per candle power; the mean fall in candle power from the beginning is only 3.8 per cent; one of the lamps, still burning after 600 hours, has the same candle power as at the start, and has an efficiency of 2.72 watts per candle after 600 hours, its mean during that period having been 2.68.

TEMPERATURE OF INCANDESCENT LAMP FILAMENTS. Janet. "L'Eclairage Elec.," March 19.—A reprint of an Academy paper. Some time ago he proposed a method of measuring the temperature of lamp filaments or any radiating body, and which consists of studying the variations of resistance as a function of the voltage, of the time and of the resistance of the cold lamp. This method has now been applied by some of his students and the results are given; for three lamps the temperature was found to be nearly uniform, averaging 1620° C.; Weber found 1300°, and Chatelier gave 1800°, but it is thought that in the latter case the lamps were forced. It is easily demonstrated that for equal lighting power the weight of a filament varies inversely as the two-thirds power of the difference of potential at the terminals.

ENCLOSED ARC LAMP.—"Elek. Anz.," March 24.—A brief illustrated description of the "Strela" lamp. The mechanism, which is only indistinctly shown, consists of a train of gears which is released by the core of the coil and the regulation is therefore very simple and is claimed to be very exact. It is also adapted to alternating currents. Great care is taken to keep the carbons dry, as it is said to be impossible to keep the light steady unless they are dry.

ENCLOSED ARC LAMP.—"Zeit. fuer Elek.," March 20.—An illustrated description of a form of lamp made by the General Electric Company of Germany.

Power.

LARGE POWER PLANT.—"L'Elec.," March 26.—After calling attention to the uneconomical way in which water powers are used in Switzerland, a mention is made of the very large project of the Oerlikon Company, which consists in creating a large lake in the upper part of the Sihl River, to act as an accumulator, so that the power will be greater than the present minimum; a fall of 450 metres will be obtained and the waters will be discharged directly into Lake Zurich; the power will be 40,000 horse-power during ten hours, or proportionately greater for shorter time; it is to be used in the city of Zurich.

POWER DISTRIBUTION. Addenbrooke. Lond. "Elec. Rev., March 25.—An editorial abstract of his recent paper outlining the scheme for the Midland Company; it was referred to briefly in the "Digest," March 12.

IMPROVEMENT IN POWER PLANT. Bement. "Cassier's Mag.," April.—A short article in which he calls attention to the great waste in the auxiliary machinery in power plants, such, for instance, as the pumps, which in some cases require twenty times the steam per horse-power than an engine. He suggests the use of pumps driven by electric motors and the general use of such motors in the place of small engines; there is no great danger of the interruption of the current, as there is always at least one unit in service, or there may be a storage battery; the same applies to other than electric plants in which the auxiliaries are driven from the main engine or the shafting. He suggests also the use of condensers and no feed water heaters, as there should be no exhaust steam; he recommends the use of fuel economizers consisting of iron tubes between the boilers and the chimneys, and believes these have not been justly appreciated; a greater draft is then required; he believes mechanical draft has great possibilities; with a chimney 100 feet high it was found that the cost of heating the gases was many times greater than the cost of the steam for the fan engine to do the same amount of work.

ELECTRIC TRANSMISSION OF WATER POWER. Baxter. "Pop. Science Mo.," April.—An illustrated description of a popular nature of a number of plants in this country. He states that the total number of water power transmission plants in operation in the United States, beside the one at Niagara, is over 200, and that the amount of power transmitted ranges from less than 100 horse-power to 12,000, and the distance of transmission from 1 mile up to 35.

SUBMARINE BOAT.—"Elec. Rev.," April 6.—A brief mention of some of the electrical features of the Holland submarine torpedo boat, to which frequent references have already been given in the "Digest." The storage battery consists of sixty cells, weighing 45,000 pounds, and capable of discharging at 300 amperes for six hours; they are charged by means of a gasoline engine and dynamo when the boat is not submerged. Electric motors are used for auxiliary power purposes, as also for propelling the boat when submerged.

TRAVELING CRANE IN A RAILWAY STATION.—"Cassier's Mag.," April.—A brief illustrated description of the one at the Victoria station, Manchester, England, which has been referred to before in these columns.

POWER FOR TANNERIES.—"Elec. Eng.," April 7.—An illustrated description of the application of a certain motor for direct driven machinery in a tannery.

WAVE MOTOR.—"Elec. Eng.," April 7.—An illustrated description of the Wright wave motor, which has been subjected to a working test of over thirty days on the California coast; the results of some tests are given.

Traction.

ACCUMULATOR TRACTION WITH SHUNT MOTORS. Fischinger. "Elek. Zeit.," March 24—A description, accompanied by a large number of diagrams, of his apparatus and tests of a car which has been running experimentally in Berlin. The car has a capacity of forty-two passengers; the weight of the accumulators is 6840 kg., the total weight of the car without passengers being 17,120 kg.; there are 180 cells of 220 to 260 a. h.; the round trip is made ten times a day, the total distance being 156 km.; the measurements which he made and the results of which are given in curves, were made in wet weather, at which time the resistance of the rails was less. The accumulators are in two sets, which are discharged in series or separately; the mean result for the round trip was as low as 18.91 watt hours per ton km.; the mean speed was 15 km. per hour and the greatest on a level 23; instead of the usual friction brake, the motors were reversed and finally short-circuited, thus restoring some of the energy to the batteries and relieving the motorman of much labor, the friction brake being used for stopping on

grades; the amount of energy restored was not measured, owing to the style of instrument used. In the overhead method the recovery of the energy he thinks will be of use in only very rare cases, as the difficulties in winding shunt magnets for 500 volts are too serious; the voltage in this case was 320 to 360; shunt motors, which like these are practically coupled mechanically, should in no case be connected in parallel if they are good motors; only poor motors with high armature resistance and armature reaction can be so connected, unless regulating resistances are used; he therefore could not use the series-parallel connections; the wires are therefore divided into two halves and the motors are wound for half the total voltage of the battery; the shunt current was broken at each stop in order to economize energy; he overcame the troubles due to the breaking of this circuit by allowing an arc to be formed which will continue for four to eight seconds, thus allowing the magnetism to die out. The controller is described and very fully illustrated.

RAILWAY STATISTICS FOR AUSTRIA.—"Zeit. fuer Elek.," March 20.—Data for the operation of the lines during the last quarter of last year.

NOTES ON CURRENT PRACTICE.—"St. Ry. Jour.," April.—Brief review of interesting methods employed on a number of lines. The power used on the Salt Lake City Railroad is taken from a waterfall some 13 miles from the city; the company formerly had a steam power station, in which rope transmission was used, and the manager states that he considers this method better than belt driving. The road was built in 1889 with 35-lb. steel rails, which were thought at that time to be heavy enough for the service; it is now thought that nothing less than 72 lb., with 36 in. angle bars, is desirable. The company has a wrecking car equipped with tools, including a jury truck, which can be placed under the disabled end of a car, allowing it to be drawn back to the car house. In Sioux City, electric brakes, in which the motors are used as generators, are giving good satisfaction. In Augusta, Ga., solid steel axle gears, forced on the shaft, are used exclusively, running with Harveyized steel pinions. In Spokane, Wash., the standard size of axles has been increased to 3¼ inches, and the company's engineers state that they believe a further advance to 4 inches not undesirable; the company still connects the positive pole of the generators to the ground and believes that this connection has certain advantages over the opposite connection. The Market Street Railway, of San Francisco, is employing an auxiliary cable system on some of its electric lines, where the grades are as high as 25½ per cent., and the system is working satisfactorily; in some of the power stations located some distance from the harbor, condensing is done by means of salt water pipe lines, and in others by surface condensers located on the roof of the power house.

EFFICIENCY OF MOTOR CARS. Cravath. "Elec. Eng.," April 7.—A note discussing some statements regarding the multiple unit system for elevated roads, for which it has been claimed that the efficiency is higher than when single motor cars or locomotives are used during light load hours; as the locomotive must be large enough for the greatest load, it was claimed not to be economical for light loads. He shows that under existing conditions it is easy to make its efficiency as high with light as with heavy trains; it is then only necessary to work them at the same rate during the time the current is turned on and allow them to drift with the current off the balance of the time; the acceleration will then be quicker and a slightly higher speed will be obtained; the theoretical efficiency of this method is higher than the former; the multiple unit system therefore gains nothing in this direction. The other point against the single motor system is that it does not give sufficient traction for long trains, but he claims that there are but few companies that care to pay for a higher acceleration rate than a single motor car affords.

TWO ELECTRIC RAILWAYS IN SOUTH AFRICA. Internat. Ed. of the "St. Ry. Jour.," April.—A description of the lines in Capetown and Port Elizabeth, which have been constructed by English capital, and both recently changed to electric power. The power station at Capetown contains three vertical tandem compound engines of 300 horse-power and one horizontal tandem compound of 800 horse-power; the last is used regularly, and supplies sufficient power to operate the road under ordinary conditions; the average consumption of coal is 8 tons per day; the station at Port Elizabeth contains three compound condensing 150-hp engines. The tracks of both companies are laid with 81 pound 6 inch rail, laid on concrete stringers with opposite joints. The average drop allowed on the feeders is 5 per cent. and the maximum 10 per cent.; the drop on the return circuit is limited to 7 volts; double deck and combination cars (California type) are used.

DUBLIN.—"St. Ry. Jour.," April.—The United Traction Company, of Dublin, Ireland, which has had for some time two short lines in operation, has recently constructed a large power house for serving the rest of its system. The station contains twenty boilers, whose construction is carefully described, and the chemical analysis of the steel to be employed is given; the piping is in duplicate; the engines are vertical cross compound, running at 90 r. p. m., and with 800 indicated horse-power at full load; the generators are for 500 kilowatts. The system of distribution is specially complete, owing to the Board of Trade regulations and conditions, some 240 tons of copper, or over a ton per car operated. In addition, two boosters are used, one on the outgoing circuit and one on the return circuit. A map showing the feeder system and areas of conductors is given.

BALTIMORE.—"St. Ry. Jour.," April.—An illustrated description of the Baltimore and Northern Electric Railway Company's system. It consists of a surburban line having about thirty-six miles of track, and located in the northern suburbs of Baltimore; the power station contains three 220-hp and one 500-hp compound engine; it also takes power from the belt line station of the Baltimore & Ohio Railroad; boosters are used in each station. The track inside the city limits is built of 90 pound girder rails, with Georgia pine cross ties, resting on a foundation of gravel; outside of the city it is of 60 and 64 pound T rail, placed on broken stone ballast. At one point on the road there is a single-track steel viaduct about 1400 feet long.

LIVERPOOL RAILWAY. Cottrell. "Cassier's Mag.," April.—A well illustrated descriptive article of the Liverpool docks and the overhead electric railway. The author is the engineer-in-chief of the company.

STORAGE BATTERY CARS IN NEW YORK.—"St. Ry. Jour.," April.—A description of the equipment of three storage battery cars on the Dry Dock, East Broadway and Battery Railway Company, New York. In the power station is a three-cylinder 90-hp gas engine, directly connected to a generator; the engine is self-starting by means of compressed air stored in a special reservoir and admitted to the cylinders on commencing operations; the gas is ignited by electricity; all handling of the batteries is automatic.

ACCUMULATOR TRACTION IN NEW YORK.—"Elec. Eng.," April 7.—A brief mention of the experimental trials of two cars on Grand street which have been running for thirty days, making 90 to 95 miles per day; although the conditions are very unfavorable, the power consumption has been very satisfactory, the average at the switchboard being 1.94 kw hours per car mile for a period of twelve days; the trial is considered satisfactory. An account of these trials was published in The Electrical World last week.

THIRD RAIL SYSTEM.—"Elec. Eng.," April 7.—An illustrated description of a model showing the Murphy system. A central rail in insulated sections is used; "the alternate sections are charged and the remainder dead;" cables from these sections lead to switch vaults between the tracks at intervals of a block; the car has a 20 volt accumulator connected with a rotary transformer, which converts this to 500 volts, the current from this operating the switches in the vaults; the line current then charges the accumulators through the transformer. This system was described in The Electrical World of January 29 last.

OVERHEAD TROLLEY CONSTRUCTION ON NEW DRAWBRIDGE IN NEW YORK.—"St. Ry. Jour.," April.—Description of a method of connecting the overhead system on the new Third avenue bridge over the Harlem River, New York. It has usually been the custom when installing work of this kind to leave considerable break in the overhead construction at the point where the draw connects with the approaches, compelling a car to drift past these places, often for a considerable distance. This defect is overcome in the system described.

HEAVY ELECTRIC TRACTION.—"Elec. Eng.," April 7.—Some illustrations, accompanied by a brief note, showing some of the recent work of the Walker Company. A car is equipped with four motors of 50 horse-power each and is used as a locomotive, attaining a speed of 30 to 40 miles an hour with six 40-foot trailers. Also an electric locomotive with two motors of 75 horse-power, and weighing, complete, 20,000 pounds.

REPAIR SHOP PRACTICE. Patterson. "St. Ry. Jour.," April.—The street railway company in Salt Lake City was one of the first electric roads west of the Mississippi, and was compelled early in its history to establish a well-equipped repair shop. The company has adopted babbitt in all its bearings, finding it cheaper and better than bronze. It builds all its own commutators, and keeps a record of each one, with a description of its construction, kind of material used in the various parts, kind and blackness of mica, etc.; the same is done with trolley wheels, pinions and other parts of car equipment.

SHOPS OF THE NASSAU ELECTRIC RAILROAD, OF BROOKLYN. Hobart. "St. Ry. Jour.," April.—These shops have been constructed during the past year to replace some destroyed recently by fire. A full description is given, with a list of the tools used.

COMBINED ALTERNATING CURRENT AND ACCUMULATOR TRACTION. Jorignot. "El'ty," April 6.—A translation of a brief description of the Deri system, which was described in the "Digest," July 10, last year.

DOUBLE DECK CAR FOR MIXED SYSTEM, PARIS.—"St. Ry. Jour.," April.—This is a double truck car, and the batteries are carried between the two trucks; the upper deck is covered, and has a sliding door at each end.

Installations, Systems and Appliances.

PARALLELING ALTERNATORS. Sahulka. "Zeit. fuer Elek.," March 20.—An illustrated description of the method suggested and used by Kapp in the early part of 1894 in Bristol, and which in principle is identical with the one recently described by Sahulka (see "Digest," April 2), except that the resistances are not sub-divided as much, two or three sub-divisions being considered sufficient; the method is also used in Germany. The identity of the two is admitted, although it was suggested independently by Sahulka, who also thinks that it has the following advantages: That the method of making the connections is simpler, as only one switch lever need be operated at one time; the use of a greater number of steps and resistances is thought to be better, and it enables the dynamos to be started when the full load is on the circuits in a case in which all the dynamos of a station have been stopped.

SYNCHRONIZING ALTERNATORS. Kensit. Lond. "Elec.," March 25.—A reply to the criticism of Oliver (see "Digest," last week). He claims that there is a misapprehension as to the meaning of the expression "distributing the load," and that the discussion has drifted from the original question.

SWITCH FOR HIGH VOLTAGE CURRENTS.—"Elek. Zeit.," March 24.—An illustrated description of a switch in which the break is made between a long series of cylinders made of non-arcing metal.

CENTRAL STATION ACCOUNTS.—Lond. "Elec.," March 25.—An analysis of the accounts of the Huddersfield and Kingston-upon-Thames municipal stations.

EMERGENCY SWITCHBOARD. Draper. "Elec. Rev.," April 6.—An illustrated description of an emergency board made for a lighting station in Washington which had been destroyed by fire; it is for a three-wire constant potential system.

ACCUMULATOR PLANT AT FRIBOURG.—"West. Elec.," April 2.—A brief illustrated description of the plant mentioned in the "Digest," March 19.

Wires, Wiring and Conduits.

LARGE SPAN.—"L'Elec.," March 26.—A note stating that the 2 mm. steel wire across the Wallenstadt Lake, making a span of 2400 metres, has again broken; this is probably the largest span in the world; it has now been decided to replace it by another, following the shores of the lake.

CONDUIT.—"Elec. Eng.," April 7.—An illustrated description of the Sewall conduit, which is made of sections of cement arches embedded in concrete.

Electro-Physics and Magnetism.

PROPERTIES OF X-RAYS. Röntgen. "Elek. Zeit.," March 24.—A long abstract from the reports of the Berlin Academy of Sciences, 1897, being his third contribution; he gives the results of further observations of the properties. If an opaque plate is placed between the tubes and the screen, covering the whole of the latter, some fluorescence will still be seen even when the plate is directly on the screen; he showed that this is due to the fact that the air around the tube gives forth X-rays; if our eyes were sensitive to these rays as they are to light, then such a tube would be like a light in a room filled with smoke. The brightness of a screen illuminated with rapidly intermittent rays depends on a number of properties which he enumerates. The X-rays from a platinum focus plate which are most active for showing images (perhaps he means for photographic purposes) are those which leave the plate at the greatest angle, but not much greater than 80°; thick plates have a relatively larger transparency than thin ones, that is, the specific transparency of a body is greater the thicker the body; when two plates of different bodies are equally transparent they need not necessarily be so when similarly increased in thickness; the relative thickness of two equally transparent plates of different materials is dependent on the material and its thickness, through which the rays have passed before they reach those plates; the same body has different transparencies with different tubes, "soft tubes" being those requiring a small potential and "hard tubes" those requiring a high one; he states that all bodies are more transparent for rays from hard tubes than from soft ones, and in obtaining images this must therefore be considered; the quality of the rays from the same tube depends on: The way in which the interrupter works; the Deprez form acts more regularly, while the Foucault form utilizes the primary current better; on the spark length in series with the tube; on the insertion of a Tesla transformer; on the vacuum; on other processes in the tube which are not yet fully investigated. A spark gap in series acts like a Tesla transformer, both giving more intense rays which are less easily absorbed; the smallest pressure at which X-rays are produced is very likely below 0.0002 mm. of mercury. The hardening of a tube is not produced only by continuing the exhaustion; to soften a hard tube, air may be admitted; it may be warmed, or the current reversed, or very strong discharges sent through it, but the latter generally changes the character of the tube; good results were produced with a tube containing a piece of charcoal of linden wood. The composition of the rays from a platinum anode depends largely on the time element in the current; the quality of the rays does not change with changes of the primary current, or at least very little, but the intensity is proportional to the strength of the primary current between certain limits. He draws the following conclusions: The radiation consists of a mixture of rays of different intensity and absorbability; the composition depends greatly on the time element in the current; the rays produced by the absorption of bodies are different for different bodies; as X-rays are produced by cathode rays, and as both have common properties, it is probable that both processes are of the same nature. If two screens are illuminated with two tubes of different hardness, the illumination being made equal, and if then replaced by photographic plates, the one illuminated by the harder tube will be blackened much less than the other; rays which produce equal fluorescence can be photographically quite different; the usual photographic plates are very transparent for X-rays; in a pile of ninety-six filaments exposed for five minutes the last one showed photographic action. That the eye is not entirely passive to X-rays is shown by an experiment; in looking at a slit in a metal screen with the closed eye covered with a black cloth and by moving the head, a very weakly illuminated slit will be noticed; this may be explained by assuming that fluorescence is produced on the retina.

EXISTENCE OF RONTGEN RAYS IN CATHODE RAYS. Roiti. "Acc. Lincei," 6-2, 1897; abstracted in "Science Abstracts," Jan.—He describes experiments confirming the result that Röntgen radiation is due to transformation of cathode rays and not to a simple subtraction; there probably do not exist cathode rays which cannot be deflected, or if they exist, they cannot be transformed into Röntgen rays; eliminating the effects of occluded or adherent gas, it is found that different pure metals emit Röntgen rays under cathode-ray impact, which increase regularly with the atomic weight.

PROPERTIES OF CATHODE RAYS IN A POWERFUL MAGNETIC FIELD. Broca. "L'Eclairage Elec.," March 19.—He repeated the experiments of Birkeland, varying the field from zero to 15,000 C. G. S., and concludes that there are two kinds of cathode rays, those which wind around the magnetic lines of force and those which follow these lines.

NATURE OF CATHODE RADIATION. Lenard. "Wied. Ann.," No. 2; abstracted briefly in the Lond. "Elec.," March 25.—He made new experiments with very highly exhausted "observation spaces" and found that the rays always behave like moving negatively charged matter endowed with inertia. His results are thought to be very valuable and significant.

TRANSFORMATION OF X-RAYS BY MATERIALS. Sagnac. "L'Eclairage Elec.," March 19.—A continuation of his long series.

EFFECTS OF X-RAYS ON SPARK DISCHARGES. Guggenheimer. "L'Eclairage Elec.," March 19.—A reprint of an Academy paper.

SPARK DISCHARGES. Oberbeck. "Wied. Ann.," No. 2; abstracted briefly in the Lond. "Elec.," March 25.—He continues his researches with the secondary spark potentials of an induction coil and found some peculiarities of positive and negative discharges on electrodes of various shapes. On plotting the distances as abscissas and the voltage as ordinates, the slope gradually decrease for 2 spheres, until at 10 cm. the voltage remains constant at 30,000; for blunt points the same thing happens at 7 cm. with 20,000 volts; after this the potentials increase as the distance. When two points are used, one of them earthed, the negative voltage increases rapidly with the distance, but the positive, which at first higher than the negatives, decreases at 5 cm. and passes through a minimum at 48,000 volts, after which it increases rapidly. The only phenomena which gives a clue to these vagaries is the brush discharge.

VALVE ACTION OF THE CURRENT IN VACUUM TUBES. Hagenbach. "L'Eclairage Elec.," March 19.—A longer abstract of the article, of which a short abstract was noticed in the "Digest," Jan. 29.

PROPAGATION OF ELECTRIC WAVES. Heaviside. Lond. "Elec.," March 25.—In this installment of his long series on electromagnetic theory he discusses the propagation of electric waves and their attenuation in the process; a number of diagrams show the several stages of the progression. The article is recommended editorially to those interested in long distances and ocean telephony or high speed telephony, in which capacity, inductance, leakage and resistance exist.

DAMPING OF RESONATORS. Lagergren. "Wied. Ann.," No. 2; noticed briefly in the Lond. "Elec.," March 25.—He examined the damping effect in a number of cases and found only the action of resistance and radiation, but not the source of loss, supposed to have been discovered by Tesla, in the generation of a kind of electric sound wave, to avoid which he immersed the resonator in oil.

THE ARC AS A TELEPHONE. Simon. Lond. "Elec. Rev.," March 25.—An abstract of the article noticed in the "Digest," last week.

RESISTANCE OF BISMUTH. Van Aubel. "Elek. Zeit.," March 24; abstracted from the "Arch. des Sciences Phys. et Nat.," Oct.—He summarizes the results of his previous researches. The resistance, temperature coefficient and the effect of magnetism are very different for different degrees of purity; lead is the most difficult impurity to get rid of; the molecular structure has a very great effect on the properties of impure bismuth, but very little on those of pure bismuth; the temperature coefficient is positive for pure electrolytic bismuth, but is negative for some so-called pure varieties; for the pure metal the temperature coefficient remains nearly constant between zero and 100°, which is not the case for the impure metal; the determination of the resistance at different temperatures is by far the most accurate and sensitive method of determining the purity, as compared with all other physical and chemical methods and it exceeds the most careful tests with the spectroscope; the effect of magnetism on the resistance diminishes appreciably with an increase of temperature; the specific resistance of the impure metal is higher. All these results have been confirmed by the researches of others. A wire 1.03 mm. in diameter (presumably of a pure variety) has a specific resistance of 105.890 at 0° and 111.610 at 13.8° C.; between 13.8 and 56.5° the temperature coefficient is +0.00391 and between 13.8° and 72.8° it is +0.00412. Researches with bismuth are of scientific value only when the metal is absolutely free from lead, that is, made by the Lenard or Classen electrolytic method.

RESISTANCE OF RHEOSTENE. Van Aubel. "Jour. de Physique;" abstracted briefly in the "Elek. Zeit.," March 17.—An abstract, with the data, of the article which was noticed in the "Digest," Jan. 22. The results show that this material has a very high specific resistance, that its temperature coefficient between zero and 74° is remarkably constant, and that the resistance does not change with

time; it can be used for temperature measurements between those limits.

CONDUCTIVITY OF PINE WOOD. Mazzotto. "Elek. Zeit.," March 24; abstracted from the "Proc. Acc. dei Lincei," Sept. 5.—He made some determinations, the results of which are given in a small table, which showed that when ordinarily dried in the air the specific resistance is 280 multiplied by 10 to the minus nineteenth power C. G. S. units; when dried at 100° the first factor is reduced to 0.5; this is in the direction of the fibres; across the fibres the conductivity is always less, and is reduced by artificial drying, but much more rapidly.

CONDUCTIVITIES OF CARBON. Cellier. "L'Eclairage Elec.," March 12.—A brief abstract of the article noticed in the "Digest," Feb. 19.

SOFT IRON IN HIGH FREQUENCY COILS. Pellat. "L'Eclairage Elec.," March 19.—A reprint of a short Academy paper on the effect of soft iron on the mean square value of the difference of potential at the terminals of a high frequency coil. An experiment with a Tesla coil seemed to show that the iron was not magnetized, but the present writer in another experiment shows that the iron is magnetized, and that the magnetization has considerable effect on certain phenomena; in the presence of iron, no matter how little, a certain classical formula can no longer be used.

CIRCUITS WITH VARIABLE CURRENTS. Colard. "L'Eclairage Elec.," March 19.—A long abstract of a mathematical article discussing the determinations of the variable electric state of a network of wires containing resistances, inductances and capacities; it is claimed to be of interest in connection with telegraphy and telephony.

THEORY OF ALTERNATING CURRENTS. Rhodes. Lond. "Elec.," March 25.—An abstract of the Royal Society paper noticed in the "Digest," March 19.

GRAPHICAL CALCULATION OF ALTERNATING CURRENTS. Guye. "L'Eclairage Elec.," March 19.—A continuation of his serial (see "Digest," March 19).

MAGNETISM. Fleming. Lond. "Elec.," March 25.—A brief editorial reference to one of his recent Royal Institution lectures (which have not been reprinted in the electrical journals, although they have been very well spoken of). Two experiments are referred to, the first illustrating the fact that the temperature at which iron passes from the ferro to the paramagnetic condition is not the same as that at which the opposite transition occurs, and is dependent on a thermo-electric action between magnetic and non-magnetic iron; to show this, a steel wire was placed in circuit with a galvanometer and was heated in a small part by a flame. The second experiment showed that the temperature of recalescence is a critical temperature in the magnetic properties of ferro-magnetic substances; the recalescent point coincided exactly with the passage from the ferro-magnetic to the paramagnetic state, or the reverse.

MAGNETIC AFTER-EFFECT. Klemencic. "Annal. Phys. Chem.," 62, p. 68; abstracted briefly in "Science Abstracts," Jan.—He studied the after-effect within the first few seconds after making the magnetizing current and the dependence of the after-effect on the dimensions of the rod and the field intensity. The magnetization curves show that the induction is very nearly complete in steel 0.0312 seconds after magnetization, whereas in soft iron an after-effect is perceptible later than this; the effect is limited almost exclusively to weak fields; it cannot be eliminated by strong magnetization; it is a temporary property which is strongest after a specimen has been raised to a red heat, and gradually diminishes as time goes on.

MAGNETIC TORSION. Moreau. "Jour. de Physique," March; abstracted briefly in the Lond. "Elec.," March 25.—A further study of the phenomena of magnetic torsion leading to the discovery of very simple laws which may be applied to the measurement of magnetic fields; these laws are that: "At any point of a twisted wire outside the magnetic field the magnetic torsion is proportional to the initial torsion at the point considered and to the square of the field (if not too strong) and independent of the diameter of the wire. Along the wire the magnetic torsion is a maximum at the boundaries of the field and falls to zero at some internal point." The independence of the diameter is only approximately correct.

MAGNETIC SCREENING. Erskine. "Annal. Phys. Chem.," 62, p. 145; abstracted briefly in "Science Abstracts," Jan.—A glass hard needle when magnetized is a good test for rapid electric oscillations; they partly demagnetize it; he uses this property for measuring the screening action of metallic cylinders against a rapidly varying magnetic field.

TEMPERATURE COEFFICIENTS OF MAGNETS. Ashworth. Lond. "Elec.," March 25.—An abstract of a paper noticed in the "Digest," March 19.

DIFFUSION OF RESIDUAL GASES IN VACUA. Merritt. "Phys. Rev.," March.—A short article describing an illustration of the phenomenon of slow diffusion of the residual gases in high vacua.

Electro-Chemistry and Batteries.

ELECTROLYTIC GOLD DEPOSITING. Wohlwill. "Zeit. f. Elektrochemie," Feb. 20, March 5 and March 20.—A long article on the deposition and solution of gold by electrolysis, in which he shows that the departures from the electrochemical equivalent of gold from the normal trivalent gold continue to be in the same direction with current densities below those which are suitable for the deposition of gold, and that therefore with continuous diminution of the current density the equivalent will become greater; in hot chloride of gold solutions in hydrochloride acid, with current densities above 1500 amperes per sq. m., the trivalent equivalent of gold was almost reached and in the same solution, with a current density of about 1 ampere, a close approach to univalent gold was obtained; in the electrolysis of gold solutions with acid between gold electrodes unequal quantities in the deposit and the anode loss may therefore correspond to the same current strength; electrolysis under these circumstances seems to show that the law of the electro-chemical equivalents does not always apply.

OZONE AND MOISTURE. Andreoli. Lond. "Elec. Rev.," March 25.—A short criticism of the recent statements of Shenstone (see "Digest," March 26), which he claims upset all the accepted ideas concerning the production of ozone; his own impression has always been and still is that one of the principal conditions to get a good yield of ozone is that the air must be dry, and his experience shows that moist air does not give good results. The silent discharge forms water vapor and hydrogen, and the latter is burned in contact with ozone, producing heat which destroys still more of the ozone.

"ZEITSCHRIFT FUER ELEKTROCHEMIE."—The issue of this journal for Feb. 20 has not been received. It will be abstracted as soon as a duplicate copy can be obtained.

ALKALI WORKS AT NIAGARA FALLS.—"West. Elec.," April 2.—A brief illustrated description of the Mathieson works, where the Castner process is used.

ELECTRICAL EQUIPMENT OF PLATING PLANTS. Burgess. "West. Elec.," April 2.—An article giving general hints and advice.

Units, Measurements and Instruments.

LEGALIZING ELECTRICAL UNITS IN GERMANY.—"Elek. Zeit.," March 24.—A reprint of a proposed bill before the Reichstag concerning electrical units and standards in Germany. The standards are to be the ohm, the "amper" and the volt; the ohm is defined as a resistance at melting ice, of a column of mercury 1 sq. mm. in cross section, uniform throughout, 106.3 cm. long and having a mass of 14.4521 gr.; the "amper" is based on a deposit of 0.001118 gr. of silver per second from silver nitrate; the volt is defined by the ohm and the ampere. The Government is furthermore empowered to determine the conditions for reproducing the ampere, to define the other dependent units, the multiples and submultiples, and to determine in what way a current, E. M. F., work and effect, of alternating currents are to be calculated. The use of incorrect measuring instruments is forbidden and is punishable, the limits of allowable inaccuracies being left to the Reichsanstalt to determine; the Reichsanstalt is also to produce standard mercury ohms and provide for the control of them at different places; secondary standards are also to be made and to be tested yearly; it is also to provide standard cells, and that the official testing of such standards is to be uniform over the whole country; the use of incorrect instruments for measuring electrical energy commercially is punished with a fine and imprisonment and the instruments may be confiscated. The law is to take effect Jan. 1, 1902.

PLANIMETER FOR RECORD CURVES.—"L'Elec.," March 26.—An illustrated description of the Richard planimeter for integrating or summing up the curves drawn by recording ampere, volt and watt meters, such as are used in central stations; to determine the total output from such curves is a somewhat tedious process, but with the present instrument this is very easily done. The principle of this planimeter, which is illustrated and described, is different from the usual Amsler form, and also eliminates a certain source of error; the curve, which is supposed to be drawn on the usual revolving drums, is placed on the drum in the present instrument and is then traced by means of a point, the integral or sum being read off on dials. (The instrument appears to be very ingenious, and if accurate it will probably be very useful).

CAPILLARY ELECTROMETER. Behn. "Annal. Phys. Chem.," 61, p. 748; noticed briefly in "Science Abstracts," Jan.—An experimental test of Warburg's conduction current theory of the capillary electrometer; as far as it goes it verifies the theory.

ALTERNATING CURRENT VOLTMETER—"L'Elec.," March 26.—An illustrated description of the instrument of Ebert and Hoffman, a very brief description of which was notified in the "Digest," April 9.

CONDENSERS. Boucherot. "Bul. Soc. Int. des Elec.," Feb.—The complete paper, an abstract of which was noticed in the "Digest," March 12.

METHODS OF DETERMINING THE RESISTANCE OF THE RAILWAY FEEDER CIRCUITS AND GROUND RETURN LOSS. Herrick. "St. Ry. Jour.," April.—The method described does not require the employment of a special wire, as in that proposed by Jeter in the last number of that journal. The author first describes the rheostat employed in the test. It is of the barrel type, and a solution of carbonate of soda is declared preferable to one of salt or sulphuric acid. Three different methods of testing these losses are described, and one of testing the amount of current returning on underground pipes.

Telegraphy, Telephony and Signals.

TELEPHONY IN GLASGOW.—Lond. "Elec. Rev.," March 25.—Long extracts from Sheriff Jameson's report concerning the Glasgow telephone inquiry. It is also briefly referred to editorially in that journal and at greater length in the Lond. "Elec."

TELEPHONY IN DENMARK, SWEDEN AND NORWAY. Beringer. "Elek. Zeit.," March 24.—An abstract of a recent paper on the telegraph and telephone in those countries.

WIRELESS TELEGRAPHY. Slaby. "Elec. Eng.," April 7.—A brief abstract of a recent article in the "Century Magazine," giving a summary of the work done by the early workers, such as Hertz and Tesla.

Miscellaneous.

DANGER OF ELECTRICAL APPLIANCES IN COAL MINES.—Lond. "Engineering," March 25.—An abstract of the recent article by Heise and Thiem, which was abstracted in the "Digest," Jan. 29 and Feb. 5 and 12.

ABSTRACTS.—A monthly publication called "Science Abstracts, Physics and Electrical Engineering," has just been started under the direction of the Institution of Elec. Eng. and the Physical Society of London, beginning with Jan. of this year. This takes the place of the abstracts formerly published independently by these two societies; the editor is J. Swinburne. The present number contains numerous abstracts of articles already noticed, although often more briefly, in the "Digest."

Improved Telephone Switchboard.

The Connecticut Telephone & Electric Company, Meriden, Conn., has spent a large amount of money and applied a great deal of work in perfecting the most important of all telephone apparatus, namely, the switchboard. The company's present board represents the work of two years, and is claimed to be the most perfect and most quickly operated board ever devised. By combining the jacks and drops, the space of the board of the ordinary type has been limited. The company in developing this board also made an effort to overcome the multiplicity of operations required on the ordinary type of board. This result has been accomplished by (1) combining the jacks and drops so that the shutter can be reset when the plug is thrust into the spring jack of the calling subscriber; (2) by doing away with extra clearing out drops, using the subscribers' drops for clearing out; (3) by doing away with the cutting into the cord circuits and the use of switch levers, this being accomplished by making every drop its own switch, for both listening and ringing, the listening or ringing being done with the plug. This reduces the operation of the board to practically two movements in answering a call, namely, resetting the shutter and connecting and calling up the subscriber wanted. The company in thus accomplishing these results is able to manufacture a board which is said to be in no way an infringement on the patent right of others.

The company has in operation in Des Moines, Ia., what is said to be the largest independent switchboard west of the Mississippi River, and has just completed at Oswego, N. Y., one of the most efficient exchanges in the country. In the construction of its apparatus the very best material is used, and although it is unable to compete in price with the cheaper goods on the market, it, for this reason, finds it much more satisfactory and better economy for purchasers in the long run to buy only the best apparatus.

The Connecticut Telephone & Electric Company began business in January, 1895, having for its principal object the building up of a reputation by manufacturing apparatus of the highest attainable quality and by conducting its business on strictly business principles. Its instruments are now in use in every State in the Union, in Alaska, Mexico and foreign countries, and as a result of its business policy it has all the work it can attend to and the good will of its customers. The demand for its apparatus has been so great that it has been obliged to double its last year's capacity in order to take care of the business of the present year. The company manufactures a complete line of supplies for the telephone business.

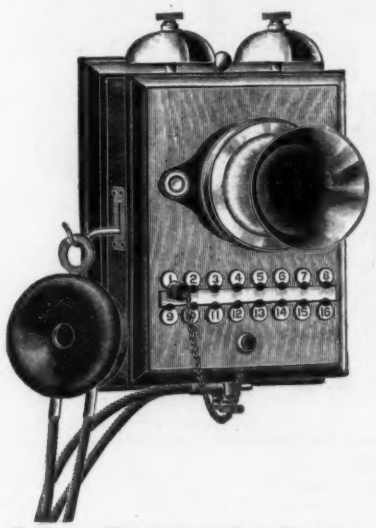


FIG. 1.—TELEPHONE BOX CLOSED.

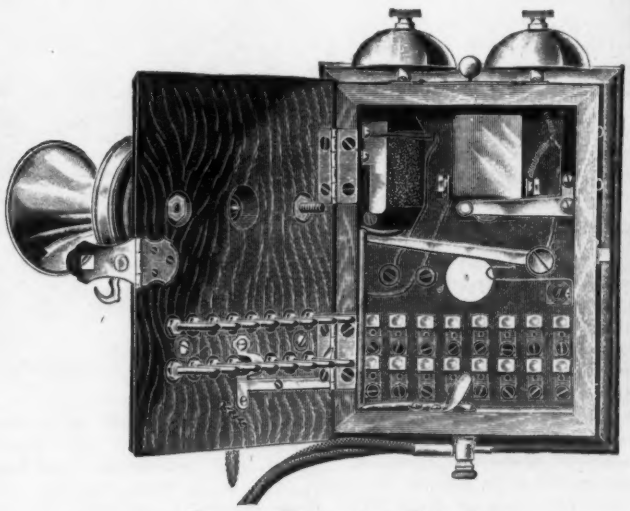


FIG. 2.—TELEPHONE BOX OPEN.

A Compact Telephone Set.

The two illustrations shown above represent a very compact wall intercommunicating telephone set, made by the Schmidt & Bruckner Electric Company, 209 Greenwich Street, New York. Fig. 1 represents the external appearance of the instrument, and Fig. 2 shows very clearly the internal arrangement of the different parts of the outfit. One admirable feature of this firm's telephones is the absence of wires and cords inside of the box, all interior connections being effected by means of contact between pins and flat springs. The pins on the door of the box, shown in Fig. 2, impinge upon flat-spring terminals when the door is closed, thus bringing the discs (shown on the front of the door in Fig. 1) in direct and positive contact with their respective lines. To call any station it is only necessary to insert a brass plug at the proper disc and ring up in the usual way.

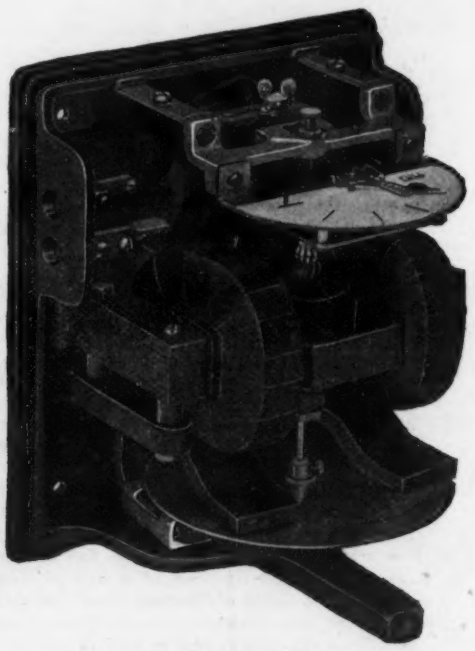
The transmitter of this outfit is of the coal-grain type, and is a very sensitive and satisfactory instrument. It is an excellent talker, and, it is said, never needs readjusting after being once set. The carbon grains are kept in a permanently dry state by means of a moisture proof protection; thus packing is avoided and the operation of the instrument is practically invariable. The transmitter is a modification of the well-known Ericsson instrument, which modification the Schmidt & Bruckner Company claims is a decided improvement over the Ericsson form. The receiver of this outfit is of the watch-case type. When it is hung up its weight pulls the switch lever down with a wide and positive sweeping contact.

Compactness is one of the most noticeable features of this set. Efficiency of operation is the principal point to keep in mind always, but of course such features are not apparent to the eye; they are only made evident by practical use. This instrument, however, is recommended by its makers to be highly efficient and satisfactory as well as compact. The construction of the Schmidt & Bruckner's Company's transmitter and outfits was described in greater detail in THE ELECTRICAL WORLD of March 5 last. The instruments illustrated herewith are new forms of apparatus recently put upon the market.

Meter for Storage Batteries.

The increasing application of storage batteries to electric light and railway station use, as well as to street cars, motor carriages, electric launches, etc., where a portable source of power is requisite, has led the General Electric Company to develop a special type of meter, which will show at a glance the amount of energy available in the battery. The Thomson recording storage battery meter resembles in general appearance the standard Thomson recording wattmeter, and is, in fact, a development from it, the mechanism being almost exactly similar. The accuracy and durability characteristic of the standard type have both been maintained, while additional precaution is provided against injury from shock or vibration. The meter is provided with a single indicating needle moving over a horizontal semicircular dial.

The essential requirement for a storage battery meter is that the armature shall rotate in either direction and give equally accurate readings in both. In this meter this requisite is fully preserved. The energy put into the cells is therefore added to the reading of the meter, while the energy withdrawn is subtracted, but to compensate for the loss in the cells the meter runs more slowly when charging. The reading of the meter represents not the amount of energy put into the battery, but the amount available, and when the needle points to zero on the dial it shows that the battery is completely discharged.



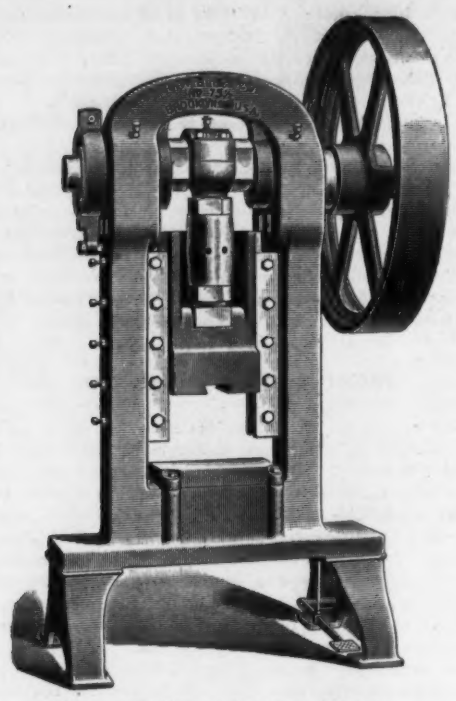
STORAGE BATTERY METER.

For motor carriage, street car and electric launch service a meter of this character is a most necessary adjunct. The durability and efficient operation of storage cells being maintained by recharging them before they are exhausted, the only method of learning of their exact condition is by a meter of this character. The cells being recharged at the right time, the general result is a much higher battery economy.

These meters are manufactured with any desired percentage difference between charging and discharging rates, and in all of the standard sizes in which two-wire Thomson recording watt meters are built. Since, however, this percentage varies in almost every case, the General Electric Company manufactures them only to order. One size, that reading to fifty amperes, however, may be considered as standard, and will be more promptly furnished than any other.

Straight-Sided Power Press.

The machine shown in the accompanying engraving illustrates a modification which the E. W. Bliss Company, 12 Adams Street, Brooklyn, N. Y., has made in its regular line of straight-sided presses. These presses are especially adapted for work requiring very heavy pressure, such as stamping, punching, blanking and shaping many different parts entering into the construction of electrical machines and attachments. They are also applicable for trimming drop forgings, either hot or cold, in which case they are supplied with a side punch. This punch is used for cutting-off purposes.



Straight-Sided Power Press.

The shafts are of very large diameter. An automatic clutch insures immediate response to treadle action. The shaft may be turned back to release the punch if stuck in the die, and it may be locked, so that for safety it is not necessary to throw off the belt when setting dies. The automatic friction clutch used when the presses are geared obviates the difficulties experienced with positive automatic clutches generally used on such machines. It acts instantaneously and avoids entirely the heavy shock, which, in positive clutches, tends to destroy the clutch parts. The large gear wheel, instead of revolving continually, is, with these clutches, keyed to the shaft and at a standstill, until the clutch is brought into action. This constitutes an additional advantage in the saving of considerable wear. Otherwise the clutch acts as usual, causing the shaft to make one revolution and stop automatically at the highest point of the stroke.

A cam stripper is applied to these presses when used for piercing and stamping. Machines of this type are made in a number of sizes, either with a fly wheel or geared, as the nature of the work may require. They are also built in an inclined position.

The E. W. Bliss Company makes a specialty of presses, dies, and special machinery.

An Improved Electric Bell.

A new bell, embodying some of the principles developed in modern forms of improved dynamos and motors, and constructed of material specially adapted for electromagnetic purposes, has been put on the market by the Osburn Electric Manufacturing Company, 294-296 Dearborn Street, Chicago, Ill. The makers claim that the base, cover, shield and armature are made of demagnetizing materials, which enables them to be drawn to a symmetrical design to be given a smooth surface and a high finish when nickeled or japanned. The magnetic circuit is made up of a core of Norway iron suitably wound and covered with a shield of "demagnetized" metal, which is upset inwardly at the ends toward the central core, thus reducing the reluctance of the magnetic circuit. The magnetism is said to have three circuits, which gives the name "tripolar" to the bell. It is claimed that these features involve a considerable reduction in the necessary expenditure of energy. In other words the bell will operate on less battery than others of the same size. The contact posts are of special design, and the armature is strongly pivoted and fitted with a double adjustment. The binding posts also have lock nuts.

The gongs are made in two sizes, 2½ and 3 inches in diameter, and of an alloy that gives a remarkably clear tone. Neither the base nor the cover is made of cast-iron, these parts being of drawn steel, the cover being stamped to a flattened hemispherical or dome shape, giving a neat and symmetrical appearance with the similarly shaped gong adjacent. The absence of cast metal reduces the liability of breakage in transportation and installation.

These bells are normally wound for one cell of dry battery, working on 100 feet of No. 18 annunciator wire. They are, however, wound to order with a higher resistance for long-distance work. An illustration of this bell is presented in the next column.

All-Metal Telephone Receiver.

The accompanying illustration shows the Ericsson Swedish bipolar all-metal long-distance receiver, the magnet of which will sustain 4½ pounds. It is a very strong instrument, and it is said to be growing in favor with the trade. It is supplied by the Ericsson Telephone Company, 10 Warren Street, New York City, which concern deals in imported Swedish transmitters, receivers and instruments. Exchanges desiring to improve the quality of their instruments, and new companies that want to start under the best conditions are invited to investigate the merits of this instrument. The Ericsson Telephone Company claims that with its equipment an exchange requires little or no repairs, and with such an equipment the patronage will naturally extend.

Improved Bell.

Telephone Receiver with Metal Case.

Automatic Topography Delineator.

The demand for a speedy method of making preliminary surveys without the usual array of engineers and instruments seems to have been met by a device recently invented by John Riddell, of the General Electric Company, Schenectady, N. Y., and entitled an instrument for delineating topographical peculiarities and measuring and recording distances.

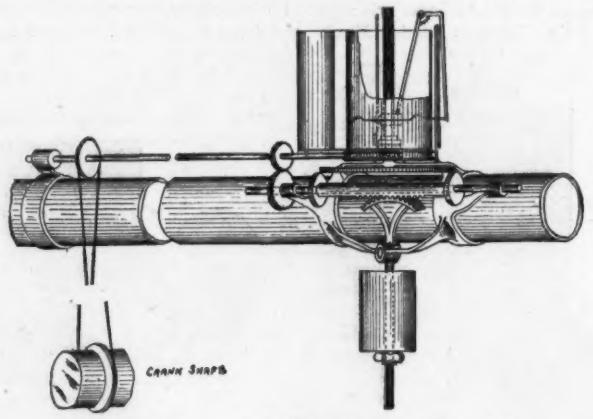


Fig. 1.—Instrument Mounted on Bicycle.

It is small and compact, and may be mounted on a bicycle or upon any wheeled vehicle drawn by horses or pushed by hand or foot. In Fig. 1 it is shown mounted on the horizontal upper bar of a bicycle, and consists, briefly, of a vertical revolving cylinder carrying the record, and a marker moved upward and downward by the inclination upward or downward of the upper bicycle bar.

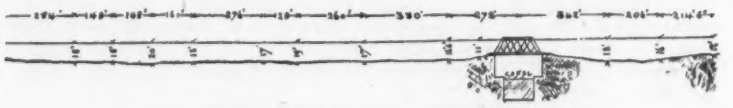


Fig. 2.—Portion of Topographic Record.

The metal cylinder carrying the paper for the record is provided at the lower end with a worm wheel engaging with a worm on a shaft running toward the rear of the bicycle and driven by a lace belt from a pulley on the crank shaft.

Movement of the bicycle produces, therefore, revolution of the record cylinder, which, as it revolves, unwinds the paper for the record from a small drum.

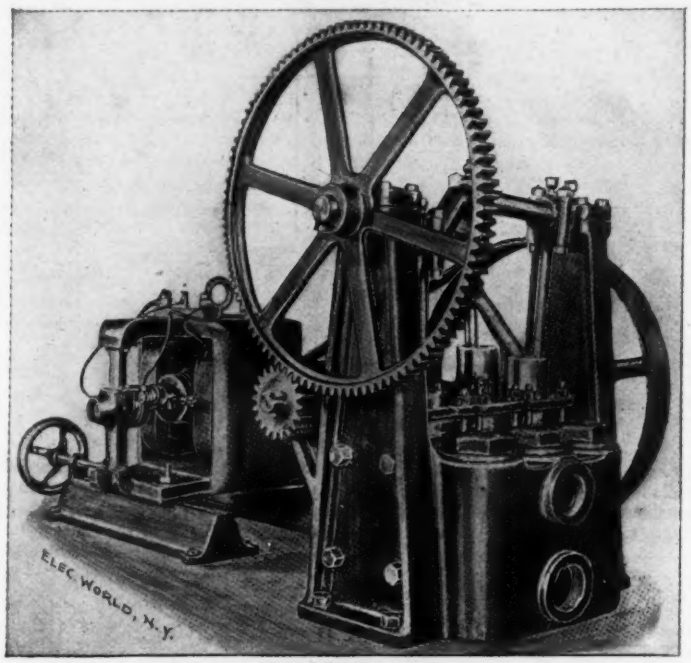
The marker is mounted on a nut on a threaded vertical rod, movement of which raises or depresses the nut and the marking point. The lower end of the rod is fastened to a horizontal disc free to move clockwise or the reverse. Beneath the disc and just clearing it on each side are two smaller discs, at each end of a toothed sleeve and revolving vertically. Through the sleeve passes the disc shaft provided with a gear wheel meshing into a small gear on the main shaft driven from the crank axle.

Suspended beneath the bar of the bicycle and consequently beneath the entire machine is a pendulum having at its upper end a toothed quadrant, meshing into the teeth of the sleeve on the shaft carrying the vertical discs. As the small disc revolve in the same direction, one in contact with the large horizontal disc revolves it clockwise and causes the marker to ascend, the other counter clockwise depressing the marker. The nearer the centre of the large disc, the small disc comes the faster the former moves and the sharper the angle described by the marker. It will be seen that the pendulum hangs vertically whatever be the angle of inclination of the bicycle.

A part of a record is shown in Fig. 2. The number of feet above the level are shown by the horizontal line, the distance traveled by the length of the record. It is part of a record made on a wheel ridden from the gates of the General Electric Company's factory to the main street of Schenectady.

An Electrically Driven Pump.

The illustration accompanying this article represents a vertical triplex pump manufactured by Mr. M. T. Davidson, 133 Liberty Street, New York, and belt driven by a Crescent motor, made by the Crescent Electric Machine Company, 647 Kent Avenue, Brooklyn, N. Y. Although the connection in this case is by means of belting, it may be made by gearing from a line of shafting. The cranks of the pump are so set that the plungers are brought on the water column, without shock from the reverse stroke, thus insuring an even and steady



ELECTRICALLY DRIVEN TRIPLEX PUMP.

delivery. The pumps are made in five standard sizes, with delivery capacities ranging from 10 to 112 gallons per minute.

The motor used in operating the pump is the well-known C. & P. machine. It is of the iron-clad, slow-speed type, and designed for heavy duty on constant potential circuits. The two poles project inwardly from the massive field frame, which is square in shape, and these form a substantial support for the field coils, which are also square shaped. The motor, while compactly built, with a generous supply of material, is well ventilated, thus keeping down the temperature to a low point. The armature bearings are supported by extension pieces from the base and top of the field frame.

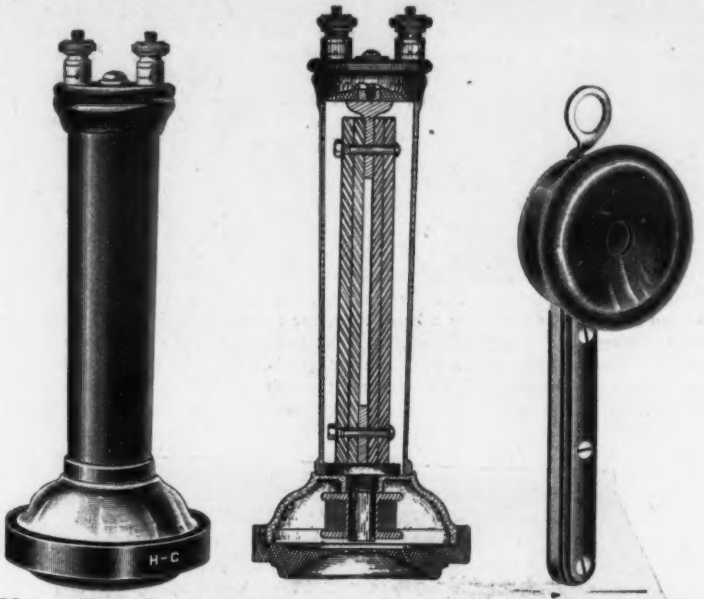
The motor rests on skids and is provided with a belt-tightening apparatus.

Metal Head Telephone Receivers.

We present herewith illustrations of a new metal head receiver, manufactured by the Holtzer-Cabot Electric Company, Brookline, Mass. The construction of this receiver is shown in the sectional view. The head or cup is of metal which is screwed on and firmly attached to the metal tip, which also carries the compound bar magnets; the rubber shell is simply slipped over these and held in place by a screw at the further end. The adjustment between the tip and diaphragm, it will be seen, is permanent, and cannot be, even in the slightest degree, affected by changes of temperature.

This is claimed to be a more practical form of receiver than any of the adjustable head styles on the market. Inexperienced men with more inquisitiveness than practical knowledge of telephonic conditions, can by "just altering the adjustment of the latter a trifle" throw them out of order, or seriously impair their efficiency. This contingency is provided against in the construction of the H. C. metal head receiver, by making the adjustment at once perfect and permanent.

Beside the above, this concern manufactures standard and pony receivers. They use in these best hard rubber shells of sufficient thickness to insure their not varying materially under changes of temperature, while they make a strong point of the fact that by their method of construction they positively prevent rust from falling down and accumulating upon the magnet tip.



METAL HEAD RECEIVER. SECTIONAL VIEW. WATCH-CASE RECEIVER WITH HANDLE.

The company also manufactures a bipolar watch-case receiver and a single pole watch-case receiver with handle. This latter is claimed to be the most convenient form of receiver made.

Exhibitors at the New York Electrical Exhibition.

In THE ELECTRICAL WORLD of February 19 last was published a list of names of intending exhibitors at the Electrical and Kindred Industries Exhibition, to be held at Madison Square Garden, New York, from May 2 to May 31. In addition to this list other names have just been announced as follows:

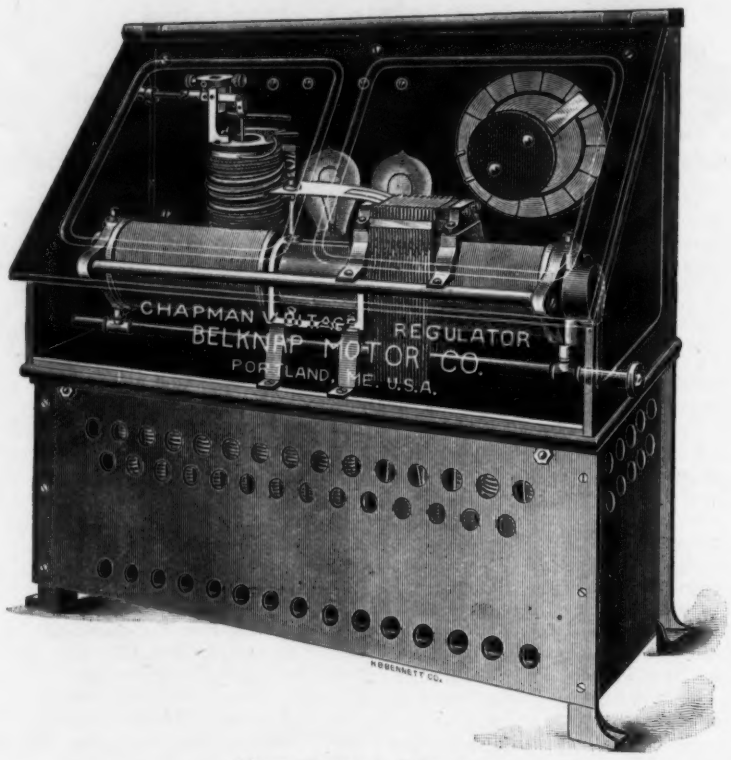
American Electric Novelty and Manufacturing Co., New York.
American Circular Loom Co., Boston, Mass.
Barrows & Co., C. H., New York.
Broomell, Schmidt & Co., York, Pa.
Boston Electroduct Co., Boston, Mass.
Burhorn & Granger, New York.
Babcock & Wilcox Co., New York.
Cutter Electrical and Manufacturing Co., Philadelphia, Pa.
Elliott & Hatch Book Typewriter Co., New York.
Electrical Engineer Institute of Correspondence Instruction, New York.
Francis Brothers, Philadelphia, Pa.
Garton-Daniels Electric Co., Keokuk, Ia.
Garvin Machine Co., New York.
General Incandescent Arc Light Co., New York.
Griffing Iron Co., A. A., Jersey City, N. J.
Hope Electric Appliance Co., Providence, R. I.
International Arc Lamp Co., New York.
Kieley & Mueller, New York.
Kosmic Oil Filter Co., Easton, Pa.
K. & W. Co., Pittsfield, Mass.
Katzenstein & Co., L., New York.
Kensington Engine Works, Ltd., Philadelphia, Pa.
Kirkland, H. B., New York.
Lewis Tool Co., New York.
Lynn Incandescent Lamp Co., Lynn, Mass.
Monarch Manufacturing Co., Waterbury, Conn.
New York Car Wheel Works, Buffalo, N. Y.
New York Telephone Co., New York.
Prindle Pump Co., New York.
Partridge Carbon Co., Sandusky, Ohio.
Pope Manufacturing Co. (Motor Carriage Department), Hartford, Conn.
Platt Manufacturing Co., O. S., Bridgeport, Conn.
Riker Electric Motor Co., Brooklyn, N. Y.
"Street Railway Review," Chicago, Ill.
Shaw, H. M., New York.
Samson Cordage Works, Boston, Mass.
Universal Electric Co., New York.
Worthington Water Tube Boiler, New York.
Williams, J. P., New York.
Warren-Medbery Co., Mechanicville, N. Y.
Wilday, J. H., New York.
Warren Electric and Specialty Co., Warren, Ohio.
Ziegler Electric Co., Boston, Mass.

The Brooklyn Polytechnic Institute, and Dr. Samuel E. Sheldon, its professor of physics and electrical engineering, have loaned the Electrical Exhibition several interesting units and standards upon which precision in electrical measurements is based. The exhibit wil include some standards from the German Imperial Physico-Technical Institute (Reichsanstalt), whose celebrated work has been done under the guidance of such men as Helmholtz and Kohlrausch; and it is probable that these standards have never before been exhibited in public in this country. Dr. Sheldon will show the Reichsanstalt form of the standard Clark cell, the Reichsanstalt pattern of photometer with Hefner amyl-acetate standard lamp, and Lummer Brodhun contrast screen, standard .01 ohm for carrying heavy currents, large standard compensation set for the precise comparison of voltages from .01 to 1200 volts and currents of any magnitude,

standard Wheatstone bridge, Thomson's double bridge for conductivity measurements, standard Carhart-Clark cell, etc.

New Voltage Regulator.

The new Chapman voltage regulator, manufactured by the Belknap Motor Company, Portland, Me., embodies all the essential principles of the original type, but is constructed in a more simple and effective form, the working parts being reduced to a minimum and arranged for the greatest convenience of manipulation, the needs of central stations having been more carefully studied. It consists of three essential parts, viz.: A set of resistance coils to be inserted or removed from the field magnet circuit of the generator to be regulated, a working solenoid to do the work of inserting and removing the coils from the circuit, and an auxiliary or relay solenoid to determine the movement of the working solenoid. The resistance coils are made of german silver, of a size sufficient to give ample radiating capacity for the field current of the generator for which they are constructed. They are connected to a series of copper segments placed in a horizontal row, and having a contact slider arranged to move over their surface. This contact slider is mechanically connected to the moving core of the working solenoid. The working solenoid consists of two differentially wound coils of wire placed on a brass tube, one at each end of the tube, and the whole placed in a horizontal position. The middle portion of the tube is left vacant. Inside of the tube a soft, iron plunger is fitted as a piston to the tube and somewhat shorter than the distance through the two coils; at the centre portion of plunger a rod is attached which passes out through a longitudinal



New Voltage Regulator.

slot cut in the vacant portion of the tube. The contact slider above described is attached to this rod and so moves with it and with the iron plunger. In order to prevent too quick a movement of the plunger a simple and ingenious retarding device is used, in which the moving iron plunger is made to serve as a dash pot. From one end of the brass tube to the other a small pipe is connected, having a hand valve in it, to regulate the flow of oil. The two ends of the brass tube, together with its connecting pipe, are completely filled with oil and closed up tight. The movement of the iron plunger toward either end can then take place only as it displaces this oil and causes it to move through the pipe and to the other end, and the rapidity of this movement can be very finely adjusted by means of the valve above described.

The force tending to move the iron plunger is the difference between the attractions of the two end coils, and this balance is maintained or upset by the action of the small auxiliary solenoid, whose only work is to cause one or another of the two platinum pointed screws to make contact with the brass lever supporting its core. Contact with one screw causes perfect neutralization of the differential coil at one end of the working solenoid and so disturbs the balance and causes the plunger to move toward the other coil, and contact with the other screw causes neutralization of the coil at the other end and a movement in the other direction. The small solenoid may be wound to suit a variety of purposes, any one of which may be required in station regulation. It may be wound with a simple fine winding to be connected as a shunt across the lines to be regulated and in this case it will secure constant potential regulation at the point of attachment to the line. Or it may be wound with a fine winding connected as a shunt to the line and a coarse winding in series with the line, in which case it will regulate for constant potential at some distant point which may be predetermined by the setting of an adjustable compounding switch provided as a part of the regulator. Or, the small solenoid may be wound with a single coarse wire placed in series with the line; in this latter case it will secure regulation for constant current in the lines. But whatever be the nature of the regulation the small solenoid will perform its duties with an accuracy as close as 1 per cent. above or below the normal, and is adapted to either direct or alternating currents.

Alternating currents are especially capable of close regulation by this instrument, as the slight jar incident to their flow through the small solenoid almost entirely eliminates the element of friction at the pivots of the lever supporting the core, and it will easily recognize a change of one-half of a volt on a 110-volt circuit. The economy of good regulation is at once apparent when it is remembered that the life of an ordinary incandescent lamp of 50 watts and 16 candle power is greatly shortened if operated at a voltage jumping at times to a few per cent. above the normal.

This regulator may be also applied to the regulation of a constant current as well as a constant voltage, and when used for this purpose will be found especially useful in the charging of storage batteries, as it maintains a constant current from the time the charging commences until it is completed. To accomplish this result it is only necessary to add a separate solenoid, wound with a coarse wire, a double-point switch being used to shift the apparatus from the constant voltage basis to the constant-current basis of regulation.

A Handy Battery Lamp.

The little electric night lamp represented in the accompanying illustration is manufactured by the Mianus Electric Company, Mianus, Conn. It is portable, and may be connected with the source of current by a flexible conducting

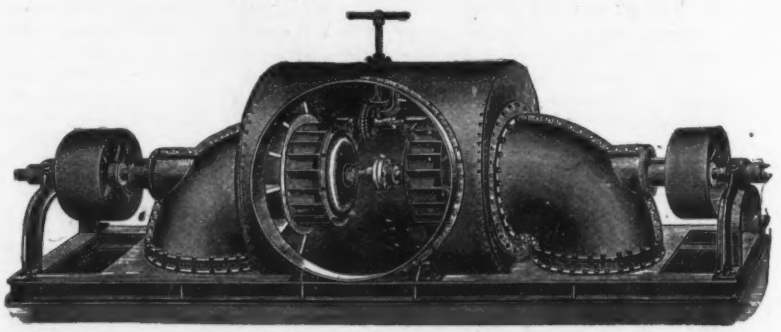
Electric Night Lamp.

cord. It may be placed in any convenient position near the bed to furnish a temporary light during the night, to light up the face of a clock, for instance. On the base a switch is provided for closing and opening the circuit. The lamp is of four candle power, and will run on four or six cells of the battery furnished by the Mianus Company. It may be used for the temporary illumination of halls, closets, etc.

Water Wheels for Dynamo Driving.

Turbine wheels of various types, among them vertical, submerged and flume, horizontal, single and twin, and open wheels with iron or wood draft boxes, are made by the Camden Water Wheel Works, Camden, N. Y.

The accompanying cut shows a pair of twin wheels mounted on a horizontal shaft and fitted with symmetrical underhung pulleys on both ends of the shaft



Water Wheel.

for belt driving. The wheels are shown in an iron flume, and are made with a supply pipe attachment directed at any angle desired. The water is discharged from the runners outwardly and axially, and is directed downward by quarter-turn draft tubes. The governing is effected by a register gate cast in one piece and movable within the fixed gate case surrounding the runner. As shown in the illustration the wheels are fitted for hand governing, but, of course, they can be attached to any automatic speed regulator.

NEWS OF THE WEEK

Financial Intelligence.

A MEETING of the preferred stockholders committee of the General Electric Company was held in Boston on April 2, at which, it is understood, an amicable agreement was reached for the settlement of the accumulative dividend question. Touching this subject the "Boston News Bureau" says: "If the General Electric Company should settle with the preferred stockholders and correct the impairment of capital by reducing the common stock 50 per cent., and it should cost $100,000 a year to do this, there would be left for the new stock on the basis of 1897 earnings, ignoring amounts charged off, a sum equivalent to 7½ per cent. Taking only the actual surplus last year, and allowing for the preferred dividend and $100,000 cost of settlement, there would be left for the new common stock 3.7 per cent. The company is known to have done much better in 1898 than it did in 1897. On the basis of earnings for the last three years there is no question that General Electric could pay the full preferred stock dividend and at least 4 per cent. on one-half the present common stock. There is little doubt that the affairs of the company will be straightened out soon and favorably to both classes of stockholders.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, April 12, 1898.

MR. A. L. TUCKER, of the Western Electric Company, Chicago, is visiting New York on business conected with the company's interests.

MR. NORMAN W. McLAREN, of the firm of Ness, McLaren & Bate, electrical contractors and manufacturers, Montreal, Canada, was a New York visitor last week.

EXPORT TRADE IN ELECTRICAL APPARATUS.—It is stated that Messrs. William E. Peck & Co., of this city, shipped a medium-sized central station electrical plant within the past few days to Punta Arenas, Chili. The value of the plant is said to be about $15,000.

THE NEW YORK ACADEMY OF SCIENCES will give its fifth annual reception at the American Museum of Natural History, this city, on April 13 and 14 from 8 to 10 P. M., and on April 14 from 3 to 5 P. M. Admission is by ticket, and Mr. George Francis Sever is the member of the general committee representing electricity.

MR. JAMES W. EAGER, president of the Onondaga Dynamo Company, Syracuse, N. Y., was in New York last week on business. He reports that the orders of the Onondaga Company in March of this year aggregated more than the combined orders received during January, February and March last year. Messrs. Fairchild & Sumner, of 39 Cortlandt Street, represent the company in New York, and send the Onondaga Company considerable business.

THE COLUMBIA COLLEGE department of electricity, in conjunction with some of the other departments, will hold a reception and tea on Saturday, April 16. This will be the formal opening of the Electrical Building, which is under the direction of Prof. Francis B. Crocker. There will undoubtedly be a large attendance on the present occasion, as there has been when the other buildings of the university were formally opened. Electrical engineers who may not receive invitations to the reception and tea will, it is understood, be welcome to visit the Electrical Building on April 16, and see for themselves the facilities which the university possesses for teaching electrical engineering.

THE RAPID TRANSIT PROBLEM.—At the meeting of the Rapid Transit Commission on April 7 a resolution was unanimously adopted, tendering to the Manhattan Elevated Railway Company the seven proposed franchises for additional tracks and extensions. The franchises must be accepted or rejected as a whole. If the Manhattan Company desires to accept some and reject others it must make formal application to the board, so that the matter may be considered again and new conditions stipulated if the Rapid Transit Commissioners so desire. These franchises were outlined in THE ELECTRICAL WORLD of March 26, 1898. The detailed plans and specifications of the underground tunnel road were considered, and a motion to amend them by increasing the minimum height of the tunnel between the City Hall Park and the Grand Central station, from 13 to 15 feet, in order to allow the running of standard sized cars over that portion of the route, was defeated. The plans and specifications were adopted as presented, and the secretary was directed to send a copy of the form of contract for the building of the road to the corporation counsel for approval.

NEW ENGLAND NOTE.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 690 Atlantic Ave,
BOSTON, Mass., April 9, 1898.

THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION has sent to about twenty-five manufacturers of motor carriages a circular letter inviting them to make an exhibit of their products. It proposes to make this exhibit one of the chief features of the exhibition which will be held next October. It is proposed to arrange a speed contest in Charles River Park, which will give an opportunity to bring the good points of the various makes of motor vehicles to public attention. Many attractive features have been secured for this exhibition, and it is confidently believed that the attendance will be larger than at any of the previous exhibitions held by the association. It is also proposed to give prizes. The proposed conditions of the contests are: 1, speed at level grade; 2, speed at greatest elevated grade; 3, turning round in smallest space; 4, stopping at unexpected signal in shortest space; 5, economy of fuel; 6, efficiency of brake; 7, durability of machine; 8, cost of machine; 9, quickness of preparation.

PHILADELPHIA NOTES.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., April 11, 1898.

THE SAWYER ELECTRIC COMPANY, of this city, is installing the electrical conductors in the fine residence being built for Mr. Edward P. Davis, of Powers & Weightman, at Thirty-eighth and Ludlow streets.

THE AMERICAN ELECTRIC METER COMPANY reports that it is crowded with orders and has under process of construction 1000 meters at the present time. It is ordering material and going ahead as rapidly as possible. One day last week it received telegraphic orders for 61 meters.

PHILADELPHIA ELECTRICAL EXPOSITION.—The General Electric Company has signified its willingness to make an exhibit of any character and extent that the Exposition management may desire; it will show the work of its inventors or its commercial apparatus. The management has arranged for the schematic model of the Edison magnetic iron ore concentrating process. It has also arranged for an exhibit of the tube-lighting system of Mr. D. McFarlan Moore. The tubes will be used to illuminate a Turkish smoking room, so as to produce their effect under the most favorable conditions. A kinetoscope and phonographic lecture room, an electric waterfall, an electric fountain, and a chamber of electric horrors, are among the features of the exhibition that are in contemplation by the management. Definite replies have been received from a large percentage of the 100 possible exhibitors, signifying their intention to make a display.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., April 9, 1898.

THE SWITCHBOARDS to be used at the Wilkeson Street lighting station will be made by the General Electric Company. There will be seven different ones, in great part of novel pattern and costing in all about $10,000.

THE CARBIDE LIGHTING COMPANY has been organized at Niagara Falls with a capital of $100,000. The stockholders are Joseph Devine, of Buffalo; J. B. Rice, of Cambridge; J. C. Frost, of Niagara Falls, and Fred Overbury, of New York.

THE CATARACT POWER & CONDUIT COMPANY has asked for bids for seven transformers for reducing the Niagara current to a three-phase 2200-volt current, which is to be used in running the Urban flour mill and other factories in the circuit of the Wilkeson Street station. The distribution of current, reduced to 550 volts, suitable for running small plants, will be given over to the Buffalo General Electric Company.

THE WORK OF LAYING the second cable between the car barns at Black Rock and the transformer house on Ohio Street for the transmission of Niagara power is pronounced a record breaker as to speed, the average daily distance covered being about 2500 feet. The entire distance was 22,000 feet. The cable is laid, but is not all connected up yet. It is a three-conductor cable, each conductor being a 000 B. & S., stranded, the insulation being 9-32 rubber and guaranteed to withstand 22,000 volts.

THE CONTRACT for building the Buffalo, Hamburg & Aurora trolley line was let this week to Mr. G. S. W. Brubaker, of Philadelphia, who is an old builder of such roads, and quite able to complete the entire 19 miles by the middle of August. The line runs by the entrance to the Erie County Fair Grounds, which have always been difficult of access, as they are a mile from the steam roads and not on any thoroughfare. It will also tap the Jewett race course, which has a mile track covered for winter trotting and practice, and will soon have a half-mile track built inside of it.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., April 9, 1898.

THE OFFICIALS OF THE SOUTH SIDE ELEVATED RAILWAY expect to have several trains in operation by electric power by April 15. Experimental trains will be run before that time.

THE CITY OF CHICAGO has appropriated $150,000 for the extension of its municipal lighting system. Ten 150-light arc machines of the Western Electric Company's manufacture have been ordered by the city.

Milwaukee Notes.

Milwaukee, Wis., April 9, 1898.

THE CITIZENS TRACTION COMPANY, Oshkosh, Wis., has purchased 20 acres of land 3 miles south of the city, and will fit it up for a summer park.

THE CONTRACTORS of the Wisconsin Valley Telephone Company have reached Hurley with the extension of the line, thus placing the Gogebic range in communication with Eau Claire, Chippewa Falls, St. Paul and Minneapolis.

MR. JAMES E. KEELYN has begun an action against the American Bell Telephone Company for $25,000 damages, on account of the distribution of circulars and printed articles derogatory of the standing of the Western Telephone Construction Company, of which he is president.

MR. T. R. MERCEIN, secretary of the Northwestern Electrical Association, states that acceptances for transportation on the steamer from Chicago to Duluth and back should reach him by April 20, the money to be sent on or before May 20. The statement that he requested that the money be sent with the application was erroneous.

CHILTON, WIS., is to have an electric light plant. Mr. N. Bink has awarded the contracts. A 75-hp Imperial engine, direct connected to a Northern generator, will furnish current to seven street arc lights and about 600 private lights. Messrs. Peterman and Wallber are the principal contractors for this plant. A. M. Patitz is the consulting engineer.

St. Louis Notes.

St. Louis, Mo., April 8, 1898.

THE PRESIDENT of the Board of Trustees of Winstanley Park last week vetoed the ordinance granting the St. Louis, Belleville & Suburban Railway the right of way on the turnpike through the village.

MR. HENRY A. COIT, 2923 Washington Avenue, St. Louis, formerly sales manager of the Missouri Telephone Manufacturing Company, St. Louis, Mo., together with his associates, is engaged in building telephone exchanges. Two are now under course of construction, and other plants are in view.

THE MAYOR has signed the bill authorizing the Suburban Railroad Company to build a downtown loop, over Sixth, Elm, Locust and Fourth Streets. The company will pay the city $3500 for its downtown privilege. Work on the extension will probably begin immediately after the expiration of ten days, when the ordinance becomes operative.

THE ST. LOUIS TELEGRAPHERS' CLUB has two presidents and a row on its hands. About a year ago A. B. Ellison was elected president by a close vote over H. V. Crane. A factional feeling was engendered. The defeated candidate's friends met last Saturday and demanded Mr. Ellison's resignation. He declining, his place was declared vacant, and Mr. Crane elected. Mr. Ellison refuses to vacate.

Texas Notes.

San Antonio, Tex., April 4, 1898

THE BLUE RIDGE TELEPHONE COMPANY has been formed for the purpose of building and maintaining a telephone line between Stranger, Falls County, and Marlin, Tex. The company is composed of Messrs. W. S. Hunnicutt, J. C. Shaw, and R. J. Garrett, all citizens of Stranger.

THE STOCKMEN'S TELEPHONE COMPANY has been formed at Canadian, Hemphill County, for the purpose of constructing and maintaining a telephone line between Ochiltree and Lockwood, Tex., via Lipscomb. The incorporators are Messrs. George Gerlach, D. J. Young, W. H. Block, and other representative citizens of Canadian.

AFTER SIXTEEN DAYS OF STRIKE the street railway trouble at Houston, Tex., has been satisfactorily adjusted, the men being in worse position than they were before the strike was inaugurated. The settlement of the differences calls for the reinstatement of all union or association men without prejudice; nine hours' work or an equal division of time to constitute a day's work, thus allowing two crews to each car, the complement of regular men to be 116 instead of 75; disputes between employers and employees to be settled by arbitration in the future; all new men to be retained if qualified for the work; this agreement to continue in force for at least one year. Wages are to range from 13 to 17 cents per hour, according to the length of service of the men in the employ of the company.

Mexican Notes.

Monterey, Mexico, April 4, 1898.

THE CITY COUNCIL of Tacubaya is, it is reported, negotiating with Messrs. Siemens & Halske, the German electrical firm, for the installation of a new electric light plant for that city. It is proposed to put in a large plant.

NEGOTIATIONS ARE IN PROGRESS looking to the installation of a new electric light plant in the city of Oaxaca, the capital of the State of Oaxaca. Messrs. J. K. Ebert and Joseph Ketchum, of the City of Mexico, are the prime movers in the project. Oaxaca is a progressive city and is having a rapid and substantial growth.

AT A RECENT MEETING of the board of directors of the District Street Railway Company of the City of Mexico Mr. N. Brackfort presented his credentials of appointment as general manager of the system. Mr. Pablo Macedo will continue in office as president of the local board, and Mr. Rafael de Arazorena, who was acting as manager pro tem., was appointed to the position of auditor of the board of directors.

MR. A. E. WORSWICK, engineer of the firm of Wernher, Beit & Co., of London, the owners of the Federal District Street Railway system of the City of Mexico, has arrived in the latter city to assume the position of resident engineer of that system. He will superintend the work of equipping the lines with electric motive power. Mr. Worswick equipped with electrical traction the street railways of Cape Town and Port Elizabeth, in South Africa, in behalf of the same firm.

LARGE POWER TRANSMISSION PLANT.—The contract for the electrical transmission of power from the falls of the Monte Alto and Tlalnepantla rivers to the City of Mexico has been awarded to Messrs. G. & O. Braniff & Co., the representatives in the republic of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. This power will be derived from three falls on the Monte Alto and three falls on the Tlalnepantla rivers, amounting in all to about 6000 horse-power, and will be transmitted to Mexico from twenty 300-hp Westinghouse polyphase generators, directly coupled to twenty water wheels, at a potential of 22,000 volts. This is the largest and most important power transmission project ever contemplated in the republic, and the contract will amount to nearly $1,000,000.

THE NEW SCHEDULE OF RATES over the submarine cable via Galveston has just gone into effect and is as follows: From City of Mexico, Tampico, Vera Cruz, Coatzacoalcos and Salina Cruz to any point in the United States, Canada or British Columbia, $1.75, gold, for ten words, and 12 cents for each additional word; to Great Britain, Ireland, France and Germany, 44 cents, gold, per word; Belgium and Switzerland, 49 cents; Holland, Algiers, Italy, Sardinia and Sicily, 51 cents; Austria, 53 cents; Denmark and Norway, 54 cents; Sweden and Portugal, 58 cents; Spain, 59 cents; Gibraltar, 62 cents; India, $1.42; Havana, 38 cents; Guatemala, San Salvador and Honduras, 15 to 18 cents; Nicaragua and Costa Rica, 20 to 23 cents; Panama, 30 cents; Colon, 40 cents; Colombia, $1.05; Ecuador, Peru, Bolivia and Chili, $1.20; Argentine Republic, 95 cents; Uruguay and Paraguay, $1.05.

Pacific Coast Notes.

San Francisco, Cal., April 2, 1898.

THE PRINEVILLE TELEPHONE COMPANY has been incorporated, and the capital stock has been subscribed by citizens of Prineville, Ore., to secure telephone connection and a local exchange.

THE FORT WAYNE ELECTRIC CORPORATION recently sold to the Power Development Company, Bakersfield, Cal., twenty-four transformers, of an aggregate capacity of 360 kilowatts. The transformers will be used in stepping down from 10,000 volts.

THE JUMPER MINE, situated in Tuolumne County, is now operated successfully by an electric and compressed air plant, installed by the Rix Engineering & Supply Company, San Francisco. A Westinghouse generator, driven by a 250-hp Pelton wheel, furnishes the current.

THE CITY OF TACOMA, Wash., recently won its suit against the Tacoma Light & Water Company. It was claimed by the city that certain property owned by the company was subject to seizure to satisfy a judgment. The sheriff, unless restrained, will proceed to sell the company's property.

THE WESTERN ELECTRIC COMPANY recently obtained from Judge De Haven, of the United States Circuit Court, in San Francisco, a decision that that company was entitled to an injunction restraining the Capital Telephone & Telegraph Company, Sacramento Cal., from the use of the Perrin multiple switchboard, patented by Thomas J. Perrin in April, 1885. The court found that Leroy B. Firman had reduced his multiple switchboard to practice early in 1879, and several months earlier than the other patent. Manager Dillman, of the Capital Company, states that the switchboard in question is not used by his company.

THE EARTHQUAKE which shook San Francisco on the night of March 30 did no injury to the electric plants in the city, though the large brick chimney of the Hayes Street cable power house is said to have been cracked. The electric power plant at the Mare Island Navy Yard was disabled by the shock of the tremblor, and by flooding from a broken water main. Many wires of the Sunset and the Pacific Telephone companies in this city were crossed, and the Central Exchange operators were demoralized by fright for a few minutes. The Western Union Telegraph lines were crossed in pdace, and three wires were incapacitated for a time, east of Port Costa, according to Chief Operator R. W. Gillette. Night Chief Operator F. P. Medina said that the Pacific Postal Telegraph Company's wires refused to work between Sacramento and Stockton, Cal. The Associated Press wires were disabled for twenty minutes, but the whole effect upon electric wires was not much worse than that of a high wind.

English Notes.

(From Our Own Correspondent.)

London, March 30, 1898.

THE NORTHERN SOCIETY OF ELECTRICAL ENGINEERS.—Two very excellent papers have recently been read before this society—one by Mr. T. Hawkins on "Polyphase Power Distribution," and the other on "Electric Cranes," by J. G. Statter. The subject of power distribution by polyphase currents has been very much neglected in this country, and continuous currents have been generally adhered to, either from pure conservatism or from a fear of patent litigation. Mr. Hawkins' paper describes the generators and motors constructed by the Oerlikon Company, of Switzerland, of which his firm, the General Electric Company, is sole agent for Great Britain. The paper, although bringing forward little that is new, will serve a good purpose in exciting further interest among engineers generally in this more modern method of power distribution. Mr. Statter's paper on cranes differs from the papers which have been hitherto published on this subject in that it considers the question of the design of motors rather than that of the design of the cranes themselves. He divides electric cranes into three classes: First, switch con-

trolled, which includes cranes in which the motors are started, stopped and reversed for each movement by switch gearing; secondly, clutch controlled, which includes all those where the motor runs continuously and is thrown into gear either by belting on fast and loose pulleys or by a form of friction gearing or clutch, and thirdly, a switchless, clutchless type in which a constant current is used to drive the three motors, and these are started and regulated by varying the position of the brushes. He has given considerable attention to the design of cranes of the latter type, and exhibited drawings and photographs of several of them. The difficulty of sparking has been in a measure overcome.

THE TELEPHONE SITUATION.—Sheriff Jameson's report on the inquiry made into the Glasgow telephone service, about which I wrote to you some weeks ago, has now been published. As a result the Postmaster-General has written to the corporation informing them that in the present state of law they have no power to carry on the business of a telephone exchange either within or without the limits of the municipality, and under these circumstances he is precluded from assenting to the wishes of the corporation by issuing a license. Sheriff Jameson's report on the inquiry is divided into five heads. In the first place, he expresses the opinion that the service is certainly not efficient as far as it goes, but he points out that the inefficiency is mainly due to the want of complete metallic circuits and to the overhead system. The company is anxious to remedy these defects, but the corporation has refused it the necessary permission to lay wires underground. In the second place Sheriff Jameson considers the service is adequate, and that the number of call offices is sufficient, and thirdly he states that the rates are not unreasonable, in comparison with those in force in various other foreign countries. He points out the dissimilarity between the conditions obtaining in Stockholm and Glasgow, the telephone service in these two towns having been constantly compared by the corporation witnesses during the course of the inquiry. Fourthly, he states that the inefficiency is due to a great extent to the refusal of facilities by the corporation, as already mentioned under the first head, and further that this refusal is not justified on the ground of policy or otherwise. He remarks that the way in which some of the corporations speak of the streets as the patrimony of the city of Glasgow is absurd, whether regarded from the point of view of law or fact. Fifthly, he considers the question whether it is expedient to grant the Glasgow corporation a license. The most reasonable solution of the matter, he says, would be for the corporation, as other large municipalities have done, to grant to the National Company facilities for laying a metallic circuit under ground system, but since the refusal to this appears to be irrevocable, he suggests two other alternatives: First, that the post office should itself establish a competing exchange in Glasgow, and secondly that the corporation should be granted a license, if it can satisfy the Postmaster-General that financially their scheme is sound, and that they have the means of carrying it out. The postmaster's decision under the conditions of this report appears quite reasonable, however, although it is naturally occasioning much dissatisfaction in Glasgow, where, on account of the present defects in the telephone service, the action of the corporation is widely supported. The result of this will, I expect, be the death blow to the cause of municipal telephony, a thing not to be regretted. The Corporation of London are still fretting about the decisions in the law courts confirming, the right of the Postmaster-General to lay either telegraph or telephone wires under the streets and to lease them to whom he thinks fit. They are soliciting the aid of other local authorities, with a view to petitioning Parliament for an alteration in the law. The London County Council have also resolved to apply for a license to work a telephone exchange to compete with those of the National Company in London.

General News.

NEW INCORPORATIONS.

THE CLEVELAND ELECTRIC LIGHT ENLARGING COMPANY, Cleveland, Ohio, has been incorporated with a capital stock of $10,000.

THE BLUE RIDGE TELEPHONE COMPANY, Stranger, Falls County, Tex., has been formed, with a capital stock of $1,000, by W. S. Hunnicutt, J. C. Shaw and others.

THE MARSHFIELD TELEPHONE COMPANY, Marshfield, Wis., has been formed, with a capital stock of $2500. The incorporators are Robert Kraus, W. Sexton and others.

THE CITIZENS ELECTRIC COMPANY, Eureka Springs, Ark., has been formed with a capital stock of $25,000. Among those interested are W. M. Duncan, L. B. Bagden and others.

THE BUNKER HILL TELEPHONE COMPANY, Bunker Hill, Ill., has been formed with a capital stock of $2,500. The incorporators are C. J. Jacoby, C. E. Drew, S. N. Sanford and James Jenks.

THE DURYEA MOTOR VEHICLE COMPANY, Jersey City, N. J., has been incorporated by William T. Williams, Charles L. Spencer, New York, and Charles H. Hall, Jersey City. Capital stock, $1,500,000.

THE WESTERN DAKOTA TELEPHONE COMPANY has been incorporated at Aberdeen, S. Dak., with a capital stock of $10,000. The incorporators are W. L. Zeitlow, M. D. Zeitlow and W. G. Bickelhoupt.

THE GENEVA LIGHT & POWER COMPANY, Geneva, N. Y., has been incorporated with a capital stock of $50,000. The directors are P. N. Nicholas, F. C. Bloodgood, S. D. Greene, J. C. Carr and M. A. Oudin.

THE DELFORD ELECTRIC LIGHT COMPANY, Delford, N. J., has been incorporated with a capital stock of $10,000. The incorporators are Kimball C. Atwood and John B. Lozier, of Oradell, N. J., and Hugh J. Grant, New York.

THE TABER & MAYER COMPANY has been incorporated at Portland, Me., for the purpose of manufacturing telephone apparatus and other electrical supplies. The officers of the company are: President, Virginius Mayer; treasurer, Everett S. Taber. Capital, $10,000.

THE ARKANSAS POST ELECTRIC STREET RAILWAY COMPANY, Little Rock, Ark., has been organized with a capital stock of $85,000. The officers are: D. G. Gibson, president, St. Louis; Andrew F. Browne, vice-president, St. Louis; R. W. Sojourner, secretary and treasurer, Little Rock.

THE THIRD RAIL BLOCK SYSTEM COMPANY, East Orange, N. J., has been incorporated for the purpose of manufacturing a patented third rail for trolley roads. The incorporators are Louis E. Watkins and J. Warren Wiley, Springfield, Mass.; C. D. Chase, Northampton, Mass., and Howard K. Wood, East Orange, N. J. Capital stock, $100,000.

THE JOLIET RAILROAD COMPANY has been incorporated, with headquarters at Joliet, Ill., for the purpose of constructing and operating an electric street railway in Joliet and other towns, with authority to sell power, light and heat for manufacturing and other purposes. The incorporators are Clint C. Rush, W. H. Heun and A. P. Bischman. Capital stock, $600,000.

THE TELEGRAPH AND TELEPHONE.

SAVANNA, ILL.—A telephone exchange will be established here in the near future.

YOUNGSTOWN, OHIO.—A new telephone line is being erected between this place and Middletown.

MONTICELLO, IND.—The Western Indiana Telephone Company will establish an exchange in this place.

WAKARUSA, IND.—The Elkhart County Telephone Company has been granted a franchise to enter this place.

NASHVILLE, TENN.—Efforts are being made to establish an independent telephone line between Camden and Big Sandy.

COLUMBUS, OHIO.—The Rothe bill to regulate and reduce the prices of telephone service has been indefinitely postponed.

MALVERN, IA.—There is agitation among the citizens of this place favorable to the establishment of a telephone exchange.

INDIANAPOLIS, IND.—A movement is on foot among the members of the Commercial Club to organize a new telephone company in this city.

ST. PAUL, MINN.—The City Council has passed an ordinance granting the Mississippi Valley Telephone Company a franchise to operate in this city.

SOMERSET, KY.—Arrangements have been completed to build a telephone line between Somerset and Rock Castle Springs, a popular mountain summer resort of this county.

CANTON, OHIO.—The City Council has granted the right to the Carroll County Telephone Company to run a toll line into Canton. The line will be constructed in ninety days.

PEORIA, ILL.—A twenty-five-year franchise has been granted to the Central Union Telephone Company, but owing to the conditions imposed it is likely that the company will not accept it.

OMAHA, NEB.—The City Council committee has reported adversely upon the ordinance providing for submission to the voters of the city of a proposition to grant a franchise to a new telephone company.

NAUVOO, IA.—The Western Illinois Telephone Company is anxious to extend its line from Carthage through Powellton to this city. The company's lines reach a great many towns in this part of Illinois.

CARROLLTON, OHIO.—The Carroll County Telephone Company will commence at once to build its line between this place and Canton. Connection with Sherodsville, Leesville and Dell Roy will follow.

LITCHFIELD, NEB.—A telephone line is to be built between this place and Loup City. All the stock in the new enterprise has been taken. A line will also be constructed between Curtis and Stockville.

ATLANTIC, IA.—Gentlemen from Des Moines and Messena are making an effort to organize a mutual telephone exchange in this place. They are meeting with success, and the proposed company intends to cut the Iowa Telephone Company's rates one-third.

EVANSVILLE, IND.—Mayor Akin has vetoed the ordinance granting the American Telephone & Telegraph Company a franchise to operate long-distance and local lines in Evansville. The mayor's objection to the ordinance was based on the long-time franchise.

FORT DODGE, IA.—Local capitalists have organized a telephone company and have secured the passage of an ordinance granting them the required franchise. Councilman Z. W. Thomas is at the head of the enterprise. The company is capitalized at $15,000.

JEFFERSON, IA.—Mr. C. G. Cockerill has just completed arrangements for the building of a telephone line from Jefferson to Grand Junction. Work on the same has already commenced. The new line will connect with the system of the Jefferson Telephone Company.

CHATTANOOGA, TENN.—The City Council desires to dispose of a new telephone franchise, the recommendation of a special committee having been made that another company be invited to establish a system here in opposition to the East Tennessee Telephone Company.

PAWNEE CITY, NEB.—The Pawnee Telephone Company has closed a contract with the National Automatic Telephone Company, of Salina, Kan., for the construction of an exchange in this city with automatic switchboard. The switchboard will have a capacity of 100 instruments.

BUCYRUS, OHIO.—The telephone interests of this county have been consolidated with the Inland Telephone Company of this city, and new toll lines will be built at once to all points on the lines of W. S. Johnston, of Van Wert, which will be connected with the Inland Company's system.

PRINCETON, IND.—A franchise has been granted to E. E. Ebberson and Walter E. Polk, giving them the privilege of establishing a telephone exchange

in this place. They are not allowed to charge more than $1.50 per month for telephones in business houses and $1 in offices and residences.

MANSFIELD, OHIO.—The Mansfield Telephone Company, which was recently organized in this city, is making active preparations to commence business. It is proposed to charge $12 a year for residence instruments and $30 for business service. The capital stock of the company is $75,000.

NEBRASKA CITY, NEB.—Arrangements have been made by the Interstate Telephone Company, of St. Joseph, Mo., by which it will extend its lines from Tecumseh to this city. The service will be in opposition to that of the Bell Company, and materially reduced rates will be offered to subscribers.

MARSHALL, MO.—It is reported that the Standard Telephone Company has contracted for the building of a line from Kansas City to this city and will continue the same to the eastern boundary of the State. The company will build several long-distance lines in the State. Its capital stock is $300,000.

AUSTIN, TEX.—The total number of telephones in use in Texas is 10,248, according to the sworn statements of the various companies operating within the limits of the State. The special tax on telephones is 25 cents per annum for each instrument, thus making the income from this source, last year, $2562.

WHITTIER, IA.—Farmers of this vicinity have organized a telephone company. The company will operate lines from Whittier to Springville and Viola, and expects to have fifty instruments to start with. At Springville connection will be made with other lines, which will give service over the entire county.

ALBION, MICH.—The City Council has granted a thirty-year franchise to the Calhoun County Telephone Company. By the terms of the ordinance rates are fixed at $24 per year for business places and $18 for dwellings, on the basis of five-year contracts. For shorter terms of service $28 and $24, respectively, will be charged.

MASON CITY, IA.—Representatives of the Greene & Western Telephone Company, which has its headquarters at Greene, Ia., are in the city making arrangements to establish an exchange in this place during the coming summer. A company is being organized, and prominent citizens are taking active interest in the enterprise.

FORT WAYNE, IND.—The Home Telephone Company has extended its line to Monroeville and La Otto. The Home Company is establishing a private system for the street railway company. A switchboard has been installed at the office of the street railway company, which will enable ready communication with all departments of the system.

SEDALIA, MO.—The Standard Telephone Company is now constructing a line from Kansas City to St. Louis via Sedalia, which will be operated from Sedalia in connection with the Russell Long Distance Telephone Company, which already has lines in operation from Sedalia to Warsaw, Benton County, and to several other towns in southwestern Missouri.

ST. LOUIS, MO.—Property supposed to be worth $18,000,000 in franchises of railroad, telegraph, telephone, lighting and other quasi-public corporations of this city will be assessed for taxation hereafter, if the opinion of Judge Rombauer holds good. Heretofore corporate franchises have, as a rule, escaped taxation in this State. The Single Tax League has demanded that they be assessed. The league argued that according to the United States Supreme Court decisions and the constitution and revenue laws of the State of Missouri, all corporate franchises having a value were subject to taxation. In the judge's opinion franchises are property and subject to assessment for taxation.

GALESBURG, ILL.—A meeting of the representatives of the independent telephone companies in this State was held here recently, and was largely attended. Representatives were present from companies in 213 towns. It was the common sentiment that all these independent systems should be interconnected, and to carry out this design it was proposed to form a permanent organization. A committee was appointed to arrange plans to bring about such an organization. Another committee appointed was that of line construction, whose duty it will be to formulate a plan for connecting the systems and probably for encouraging the building of independent systems in counties not provided with such service.

Electric Light and Power.

ALGONA, IA.—The city has voted to grant a twenty-year franchise for an electric light plant.

MINERAL POINT, OHIO.—Plans and specifications are being prepared for a water and light plant.

HOUSTON, TEX.— The Citizens' Electric Light Company's plant was destroyed by fire. Loss, $140,000.

PITTSBURG, PA.—The Westinghouse Company has received the contract to put in the lighting plant at Columbus, Ohio.

CHAMBERSBURG, PA.—In accordance with the report of the superintendent of lighting this city's streets are lighted practically free of cost, the income from the commercial lights being sufficient to pay the running expenses and leave a balance besides.

HOUSTON, TEX.—One of the boilers in the station of the Citizens Electric Light & Power Company in this city exploded recently, killing two men and injuring three others. A portion of the station was completely demolished, and the city was plunged in temporary darkness.

ANDERSON, IND.—One year ago the city acquired the Commercial electric light works at a cost of $48,000. The first statement just made shows that during the year 18 1-3 per cent. on the investment has been cleared under unfavorable conditions. The report states that there is every promise that the investment will yield 20 per cent. during the coming year.

HAGERSTOWN, MD.—Mr. Powell Evans, of Philadelphia, it is stated, has obtained the rights from the States of Maryland and West Virginia to build a dam across the Potomac River at Wevertown. His plan is to install large turbine wheels and erect a power plant from which to furnish electric power to all factories in this section of the valley. It is stated that Mr. Evans is backed by a Philadelphia syndicate, with a capital of $6,000,000. He estimates that he can furnish electric power at one-half the cost of steam power.

The Electric Railway.

TRENTON, N. J.—The bill limiting street railway franchises to twenty-five years has passed the New Jersey Assembly.

SPRINGFIELD, MASS.—The Street Railway Company has received a petition asking for an extension of its lines to Agawam.

WALTHAM, MASS.—Newton Street Railway Company has been granted the right to build to Lexington and will begin at once.

WASHINGTON, PA.—The Charleroi, Bellevernon & Fayette City Electric Street Railway has been formally opened for passenger traffic.

FALL RIVER, MASS.—The Globe and Fall River Electric Street railroads have petitioned the railroad commissioners for permission to consolidate.

GREENWICH, CONN.—A trolley road is talked of from Danbury to Portchester, there to connect with the Westchester County, N. Y., system of trolleys.

ST. JOSEPH, MO.—Judge Culver has decided that the act passed by the last Legislature, requiring vestibules to be placed on street cars, is unconstitutional.

DETROIT, MICH.—An electric street railway is to be constructed between Belding and Grand Rapids. Heavy rails are to be used so that freight may be carried.

SYRACUSE, N. Y.—The Baldwinsville Village Trustees have refused to grant a franchise to the Baldwinsville & Liverpool Street Railway, the vote being a tie.

NEWARK, N. J.—The Somerville Board of Commissioners have ended the long trolley fight by granting a franchise to the New York & Philadelphia Traction Company.

POTTSVILLE, PA.—The stockholders of the new Easton, Palmer & Bethlehem Electric Railway have just met and organized. The building of the road will be begun soon.

WEBSTER, MASS.—The Webster & Dudley Electric Street Railway Company has been organized, and Mr. Edgar S. Hill has been elected president and Mr. John Flint treasurer.

NEWBURGH, N. Y.—Dr. Seward is representing the new Goshen-Newburgh Trolley Company at Goshen. This company will soon have a franchise to sell. It does not yet appear that anybody intends to use it.

READING, PA.—The East Reading Electric Railway Company and the East Reading Electric Light Company have been leased by the Reading Traction Company. This was done to facilitate the extension of the line.

ST. LOUIS, MO.—The Board of Commissioners of Porter County, Ind., has granted a franchise to the Hobart & Western Electric road. This line will be known as the Valparaiso, Flint Lake & Chicago Electric road.

ROCKFORD, ILL.—The board of supervisors of Winnebago County granted a twenty-five year franchise to the Rock River Electric Railway to operate its south line from this city to Oregon. The road will be built next summer.

KNOXVILLE, TENN.—It is stated that Mr. C. C. Howell will remain as manager of the Knoxville Traction Company, formed by the consolidation of three street railways and two electric light systems in this city. The deal involved $881,450.

NEW BEDFORD, MASS.—The four towns of Middleboro, Bridgewater Lakeville and Freetown, have granted a franchise to the New Bedford, Middleboro and Brockton Street Railway. The entire distance is 32½ miles, and work now will begin at once.

BALTIMORE, MD.—The Baltimore & Northern Electric line will run market cars between Baltimore and Mount Washington. It is intended to carry baggage, marketing and packages of all kinds. If the scheme is successful special baggage and express cars will be built.

WORCESTER, MASS.—W. H. Tylee has the contract for the construction of the Worcester and Clinton Street Railway, and sub-contracts will be placed shortly. The Worcester, Milford, Attleboro and Woonsocket Street Railway will not be built until a year from this spring.

CLEVELAND, OHIO.—A rate war is on between the steam and electric railroads running east and west of Cleveland. The Nickel Plate cut its single-trip fare to Painesville to 45 cents, and intermediate points are ticketed correspondingly. The officials of the electric line say they will make a further cut.

NEW YORK CITY.—The Plainfield, N. J., Street Railway Company has secured enough consents to guarantee the right of way over East Front Street for its extension to Scotch Plains. By the purchase of some property in the interest of the company the signatures of the necessary 51 per cent. of property holders was furnished.

CHICAGO, ILL.—The North Side Electric Street Railway has presented a petition to the Council asking for trolley franchises on about 7 miles of west and south side streets for fifty years without compensation. The Chicago, Milwaukee & St. Paul Railroad has again asked permission to put in electricity on its Evanston line, offering $5000 compensation.

SYRACUSE, N. Y.—The Baldwinsville & Liverpool Railway Company, Baldwinsville, N. Y., represented by Jacob C. Kenyon and Barron C. Meays, has been granted a franchise through the town of Van Buren to construct an electric railway. The board has assured the Onondaga Lake Railway Company that a similar franchise will be granted it on application.

BOSTON, MASS.—It is stated that the New England Railroad will build the third-rail line to Bristol, Conn., and that the New Haven and New England railroads have planned to operate the third-rail system on the circuit via Hyde Park and Dedham, when the new Union station is completed. It is estimated that this will greatly decrease the cost of operation.

NEWBURYPORT, MASS.—Portsmouth's electric road fight is at an end. The Boston & Maine Railroad has won the day, and will build the road. It is said to be the intention of the Boston & Maine management to equip the Portsmouth & Dover road, and the York Harbor & Beach road with electricity to operate in connection with the road to be constructed in Portsmouth.

DAYTON, OHIO.—The Dayton & Western Traction Company, which has a franchise and right of way to build an electric street railroad from here to Eaton, a distance of 25 miles, mortgaged its road and equipment to the Central Trust Company, of New York, for $400,000. This money is to be used to complete and equip the road, which is now partially built, the power house and machinery being placed.

NEWARK, N. J.—The stockholders of the Consolidated Traction Company at their annual meeting at Jersey City decided to lease their franchises and plant to the North Jersey Street Railway Company. The leased company is capitalized at $15,000,000. The North Jersey Company will now control all the trolley lines in the north part of the State with the exception of those operated by the North Hudson Railway Company, in Hoboken, Jersey City Heights, etc.

WASHINGTON, PA.—All the Monongahela towns are to be connected by electric railways. A line from Bellevernon to Charleroi, thence to Lock No. 4, has just been completed. The Monongahela City Street Railway Company is planning to extend its line south to Black Diamond and as for north as Courtney. The West Newton Northern Railway Company will build a road across to Bellevernon and down the Monongahela River to Webster. One of the lines will be extended to Brownsville later on.

ALBANY, N. Y.—The minority stockholders in the Kings County Traction Company, Brooklyn, N. Y., have petitioned Attorney-General Hancock that he intervene in the pending dissolution of the company. The petition alleges that certain persons controlling the directors of the Kings County Traction Company, together with the controlling interest in the Nassau Railroad, entered into a scheme for the purpose of benefiting themselves at the expense of the stockholders of the traction company. In order to bring about an honest dissolution of the company and for the protection of all the stockholders, the petition begs for the appointment of a receiver.

MILWAUKEE, WIS.—Work has commenced upon the completion of the Bluff City Electric Railway through Lake County in Illinois. It is said to be another step in the work of establishing an electric railway between Milwaukee and Chicago. It is also said to be the intention to extend the line to Green Bay, so that it will be possible to make an uninterrupted journey from Chicago to Green Bay, a distance of 201 miles. For the greater part of this distance the line will parallel the Milwaukee Division of the Chicago & Northwestern Railway. Between Chicago and Milwaukee there are only a few gaps left to be filled in to complete the line between the two cities.

BALTIMORE, MD.—The uncompleted Columbia & Maryland Electric Railway, between Baltimore and Washington, and known as the Boulevard line, was sold at auction, March 25, to the Baltimore Security & Trading Company for $450,000. The property was first offered in three divisions, the first including the Edmondson Avenue, Catonsville and Elliott City Railway and power houses; the second consisted of 10,625 shares of stock out of a total of 16,640 shares of the Eckington & Soldiers' Home Railway of Washington; also 5000 shares of the Belt Line Railway of that city, and all the stock and bonds of the Maryland & Washington Railroad. The third lot, included stocks and bonds of the Catonsville Short Line, now in operation. The total of the separate bids was promptly accepted. A number of persons from New York and Philadelphia, representing capitalists and railway interests, were at the sale. The road will be reorganized, but will not be operated through to Washington for some time.

PERSONAL NOTES.

MR. HENRY B. SMITH, secretary and treasurer of the Michigan Pipe Company, Bay City, Mich., is president of the National Cycle Manufacturing Company of the same city. The new illustrated catalogue of the latter concern shows it to be progressive and up to date in matters pertaining to wheels.

MR. CHARLES A. BOYD, superintendent of the Walker Company, Cleveland, resigned his position on April 12. He will enter the general engineering business for himself, with offices in the American Trust Building, Cleveland, Ohio. Mr. Boyd has been with the Walker Company for the past four years, starting as engineer in the railway motor department, having charge of the design and construction. About one year later he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on January 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

MR. F. E. HEALY, president of the Illinois Electric Company, Chicago, Ill., recently organized to conduct a general electrical supply business, was brought up in the electrical trade. For the past seven years he was connected with the Central Electric Company, of the same city. His long experience in this line of trade, together with his native ability and progressive spirit, well qualifies him to direct the affairs of this new and vigorous firm. He understands the business from A to Z, and the company of which he is the head promises to attain a position of honor and reputation in the electrical trade.

MR. L. K. CUSHING, secretary of the Illinois Electric Company, is, like President Healy, a graduate of the electrical trade, having had a varied experience covering a period of ten years. In 1888 he began his career with the

F. E. HEALY.

Chicago Arc Light & Power Company, as a dynamo man, from which position he advanced through the various departments. In 1890 he accepted a position with the Central Electric Company as assembler, and through faithful attention to business he reached the position of city salesman, and afterward became

L. K. CUSHING.

traveling salesman for the company. In 1892 he resigned his position with the Central Electric Company to accept one with the Gray Electric Company as an expert to handle Professor Gray's telautograph. He returned to the service of the Central Electric Company in 1894, as manager of the shipping department.

CARL KEITH.

Mr. Cushing is well and favorably known in the West, and is a brother of Mr. Fred. W. Cushing.

MR. CARL KEITH, treasurer of the Illinois Electric Company, Chicago, is also an old Central Electric man. He left college in 1894 to join this com-

pany's forces, filling successively the positions of salesman, purchasing agent and general stockman. Thus in four years' time he gained a thorough knowledge of the supply business, from the office work to the practical end. His purpose was to familiarize himself with the handling of goods and the prices of the same. He is a Chicago boy, and has lived in his native city all his life. During his experience he has made many friends, all of whom wish him and his associates success in their new enterprise.

Legal Note.

THE UNITED STATES CIRCUIT COURT OF APPEALS for the Southern District of New York, Judges Wallace and Shipman sitting, has reversed the decision of Judge Lacombe in the suit of the Thomson-Houston Electric Company, appellee, v. the Union Railway Company, et al., appellants, the claims involved being Nos. 2 and 4 of letters patent No. 495,443, for a traveling contact for electric railways, granted April 11, 1893, to the administrators of Charles A. Van Depoele, assignors to the complainant. This decision by the final court, although on a motion for preliminary injunction, since it is rendered upon a point of law, settles finally the long-fought ownership of this trolley patent, and renders all claims invalid. The counsel for the Walker Company, the real appellant, were Charles E. Mitchell, of Mitchell, Bartlett & Brownell, and William Houston Kenyon, of Whitter & Kenyon; the case of the General Electric Company, the successor of the appellee, being argued by F. H. Betts and F. P. Fish. This is the most important of a number of trolley patents (the others being on details) under which the Thomson-Houston Company is suing various manufacturers or users of trolleys. Among the other suits is one under Van Depoele patent No. 424,381, the special feature of which is the use of a tension spring occupying a horizontal position and pressing the trolley arm upward. Another patent under which suit is pending is No. 502,243, which relates to the use of oppositely acting tension springs, of which one set "rests" while the other is in use. Another patent of Van Depoele under which suit is pending is No. 495,383, which covers the reversible trolley; that is to say, one which may swing freely around its vertical axis so as to trail in either direction. Two other cases will be argued during the present week—one on the Anderson patent No. 412,155 and the other under the Baker patent No. 437,961. These patents relate respectively to means for conducting current from the trolley wheel to the harp, and to the use of buffer springs for checking the motion from the trolley arm when it escapes from the wire. All the principal manufacturers are under injunction with reference to the Van Depoele switch patent No. 424,695, this patent having been sustained at final hearing.

Trade Publications.

THE GARTON-DANIELS ELECTRIC COMPANY, Keokuk, Ia., has issued a neat little pamphlet on the subject of the Garton lightning arresters. These well-known devices are concisely described and lucidly illustrated.

THE PHŒNIX IRON WORKS COMPANY, Meadville, Pa., has issued an eight-page pamphlet, illustrating and describing the Moyes combine water tube boiler. This steam generator is illustrated in section and in elevation, the illustration showing the details of construction very clearly. The Phœnix Iron Works Company is the manufacturer of the Dick & Church automatic cut-off engine.

THE PARTRIDGE CARBON COMPANY, Sandusky, Ohio, has issued a new price list of the Partridge self-lubricating motor, dynamo and generator brushes. The list is very complete and embraces brushes of all sizes for all kinds and sizes of generators and motors. These brushes have been on the market several years and enjoy an excellent reputation. They are regularly used by a great many railways and electric light companies.

THE FOSTER ENGINEERING COMPANY, Newark, N. J., has issued its March catalogue (illustrated) of its "New Class W" pressure regulator, pump-seed governor, pump regulator, automatic safety stop valve, damper regulator, relief valve, inside boiler check and other specialties for steam, water, gas or air. These various devices are very carefully described and well illustrated. Engineers will be interested in the contents of this catalogue, which is well gotten up.

THE AMERICAN ELECTRICAL WORKS, Providence, R. I., never fails to remember its friends in season and out of season. As a souvenir of the Easter time it has sent out a card, which bears an excellent illustration of an egg plant. With it is a little package of egg plant seed, which the company urges its friends to plant and from it raise a commemorative egg plant, with the hope that its growth and fruit will frequently bring to mind their friends—the American Electrical Works.

THE "MECHANICAL ENGINEER" is the name of a new illustrated weekly journal published in Manchester, England, by the Scientific Publishing Company. No engineering paper is complete without an electrical department, and this newcomer is no exception. Under the head of "Electrical Notes" are published a variety of short articles on electrical subjects of a practical nature. The contents of the first number show care and excellent judgment in their selection and preparation, and the journal has a very substantial appearance. Mr. William H. Fowler is editor.

THE STANDARD THERMOMETER & ELECTRIC COMPANY, Peabody, Mass., describes and illustrates in a catalogue just issued its enclosed arc lamps for all circuits. The Upton "Midget" enclosed arc lamp is well illustrated, its mechanism being clearly shown. Among the lamps shown are the plain cover constant potential lamp, the Upton "Midget" enclosed lamp for alternating current, the lamp for constant current high tension series circuits and the enclosed lamp for direct current to burn in series. The catalogue gives instructions for unpacking, installing and trimming these lamps, beside much other information of a general character.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Mass., manufactures a line of excellent telephone apparatus, and describes and illustrates these instruments in a very neatly gotten up twenty-eight-page catalogue, just issued. It includes magneto bells, hand and power generators, motor generators, desk telephone sets, interior telephones, automatic intercommunicating telephones, telephone annunciators, receivers, transmitter arms and other telephone apparatus manufactured by the company. The catalogue makes a very favorable impression, being printed on fine heavy paper. It has a linen, paper-faced cover. Its number, 32, should be specified in sending for a copy.

THE ARMINGTON & SIMS COMPANY, Providence, R. I., has issued a artistically designed and illustrated catalogue of its high-speed, automatic cut-off engines. This company builds a great variety of sizes and types of engines designed to meet the requirements of any service, and a special line of light, high-speed vertical engines designed expressly for electric lighting service on steamships, or wherever economy of space is a factor. The illustrations in the catalogue include the standard simple horizontal engine, of the belted type; the valves, the governor, oiling devices, tandem-compound, direct connected engine, cross-compound direct connected engine, direct connected, simple, horizontal engine, and cross-compound vertical engine, direct connected. A telegraph code is given to facilitate correspondence.

THE PELTON WATER WHEEL COMPANY, San Francisco, Cal., in the last edition of its catalogue, recently issued, presents a large mass of facts interesting to electrical and mining engineers. The list of electrical installations made by this company, as shown in the pages of the catalogue, is a long one. These installations have been made within the past three years, and all of the plants referred to are in successful operation, with the exception of those of the Southern California Power Company and the British Columbia Railway Company, which are under construction. The Pelton Company claims that this list embraces the largest number of plants installed by any manufacturer of water wheels. The condition of many as to head and variety of service is exceptional. A large part of the Pelton Company's business, both in California and New York, is in connection with electric power transmission, and the indications are that it will continue to be for some time to come. The catalogue gives a brief description of many of the representative hydraulic electric plants, together with illustrations of the same. The various styles of Pelton wheels are also illustrated and described, and the engineering data given will be valuable to engineers in general.

THE INSTITUTE FOR HOME STUDY OF ENGINEERING, Cleveland, Ohio, has issued its 1898 catalogue. The various courses are very completely described in an attractive manner, and the method of instruction is clearly pointed out. The institute believes that it gives the most thorough courses to be had by this method of study, which has become very popular in recent years. It teaches electricity by a method which it claims to be distinctly its own, and the various courses are in charge of consulting engineers of repute, and who have proved themselves to be capable specialists. Examples of the work in the different courses are given, from which a very clear idea of the method of instruction is obtained. The illustrations are particularly good, those representing magnetic phenomena being especially clear and instructive. The apparatus used in the electrical engineering course are well illustrated and are said to be excellent instruments. They include a 250-watt dynamo, a combined voltmeter and ammeter, and a reflecting galvanometer. The courses taught by the institute are as follows: Shop, steam engineering, electrical engineering, electrical-mechanical engineering, surveying and railroads, bridges, roofs and structures, hydraulic engineering, advanced mathematics, complete mechanical engineering, and complete civil engineering.

Trade and Industrial Notes.

MESSRS. J. B. COLT & CO., 112 Nassau Street, New York, manufacturers of projection lanterns, will move their quarters on May 1 to Nos. 3, 5 and 7 West Twenty-ninth Street.

MR. JOHN M. LOCKWOOD has been added to the staff of the Schmidt & Bruckner Electric Company, 209 Greenwich Street, New York, manufacturers of the American coal grain microphone.

MR. GEORGE WILLIAM HOFFMAN, manufacturer of U. S. Metal Polish, which is so extensively used for polishing metal goods, has opened an office at No. 10 Finsbury Square, London, E. C., England. He will there carry a full line of goods.

THE PHŒNIX CARBON MANUFACTURING COMPANY, St. Louis, Mo., states that the volume of its business is largely increasing. The patented features of its Phœnix batteries are being widely appreciated, and the superiority of its products is attested in the demand for them, which is steadily increasing.

MR. A. L. FENTON, general selling agent of the Eureka anti-friction metal, 39 Cortlandt Street, New York, who has been away from his office for some weeks owing to an injury to his knee, has recovered and is again calling upon his customers. Mr. Fenton has recently received some large orders from the Government as a result of the war agitation.

THE NON-POLARIZING DRY BATTERY COMPANY, 625 Broadway, New York, maker of the O. K. dry battery, is running its factory to its utmost capacity. With but few exceptions the leading steam railroads throughout the country, it is stated, have adopted this battery, while the telephone companies in general are among the largest consumers.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just opened a new branch office at Austin, Tex. Mr. J. E. Johnson will have charge of the office and of the further extension of Westinghouse business in the Southwest. The large contracts which this company has been handling in Mexico and the Texas region have led to the establishment of this new centre of electrical trade.

THE AMERICAN TECHNICAL BOOK COMPANY, 45 Vesey Street, New York, has opened an electrical engineering department, free of charge to subscribers to the International Electrical Library, and for their use only. A book of "educational coupons" is supplied with the library, entitling its holder to ask questions bearing upon the subject matter of dynamo electric machinery. Answers are promptly given by a competent electrical engineer.

THE PENNSYLVANIA ELECTRIC COMPANY, Marietta, Pa., has received from the War Department a large order for telephones to be used in the forts, coast defense and signal stations along the Atlantic Coast. The order is a rush one. The "Crescent" telephones made by this company are said to embody the latest improvements in this class of instruments, and this large Government order is a compliment to the excellence of the apparatus.

MESSRS. HUEBEL & MANGER, Brooklyn, state that they are selling a great many iron box bells, and that the demand for them seems to be constantly increasing. They make several grades of these bells, and they are all good, even the cheapest. Their No. 189 bell has the very desirable patented features, such as non-turning binding and contact posts, double adjustment, etc. Every bell is well made of good material, carefully tested and is fully guaranteed.

THE PRISMATIC ELECTRIC SIGN COMPANY, Williamsport, Pa., reports that in the past two weeks it has made shipments of signs to the following cities: New Orleans, La.; Brantford, Canada; Detroit, Mich.; Canton, Ill.; Waterbury, Conn.; Wheeling, W. Va., and Great Falls, Montana. Orders have been received besides from Alpena, Mich.; Pittsburg, Washington, Johnstown and St. Louis. The company is now preparing a circular describing special signs for druggists.

THE CENTRAL ELECTRIC COMPANY, Chicago, is carrying in stock Edison fuse plugs of all sizes, standard fuse wire put up in neat and attractive packages convenient for use, fuse links with copper terminals of all lengths and capacities, as well as a full assortment of fuse strips. The composition entering into the fuse material is the result of numerous experiments, and practical tests have, it is said, determined it to be the most accurate fuse material yet offered.

MESSRS. A. L. IDE & SONS, Springfield, Ill., on April 5 were granted a United States patent on a combined shaft and disc. This refers to the construction of the improved crank shaft now used in the Ideal engines. The shaft and disc are of one piece of gun metal, or one integral casting, with steel core or strengthening rod cast in the centre of the shaft and made a part thereof. Out of several thousand engines equipped with these shafts it is stated that not one has failed to withstand the greatest strain of the most exacting service.

THE PENNSYLVANIA RAILROAD has ordered for its Altoona shops two 160-hp tandem compound engines, arranged for direct connection to 100-kw dynamos. The engines are furnished by the Ball Engine Company, Erie, Pa., and the dynamos by the General Electric Company. The city of Crowley, La., is installing an electric light plant. Ball engines, built by the Ball Engine Company, Erie, Pa., furnish the power. The city of Scranton, Miss., is installing a 75-hp Ball engine, built by the same company, to be direct connected to General Electric dynamos.

MR. JOHN G. O'NEIL, the enterprising selling agent for the A. A. Griffing Iron Company, Jersey City, N. J., located at 335 The Rookery, Chicago, Ill., is meeting with great success in introducing the Bundy steam specialties in that market. A number of his customers express surprise at the excellent results they have experienced, especially in the case of the steam and oil separator. Mr. O'Neil also sells the Bundy feed water heater, safety water column and exhaust heads. He will be pleased to hear from anyone interested in or desiring further information regarding the goods.

THE DAVIS & EGAN MACHINE TOOL COMPANY, Cincinnati, Ohio, is being reorganized under the name of the American Tool Works Company. With the reorganization an increase of the capital stock of the concern will be effected from $500,000 to $1,000,000. The steadily increasing foreign business of the company has necessitated this enlargement, and the change in name is made in the interest of this business. The new charter is granted in West Virginia. It is practically assured that Mr. Charles Davis will be continued as president of the American Tool Works Company.

THE SCHMIDT & BRUCKNER ELECTRIC COMPANY, 209 Greenwich Street, New York, manufacturer of telephones, has been compelled to enlarge its manufacturing facilities to meet the rapidly growing demand for its instruments. It has taken another loft in the same building. Its telephones are said to be giving the utmost satisfaction, and are used in some of the most prominent buildings in the city. The company announces that it will soon introduce to the trade a new enclosed, long life arc lamp, which is said to be very simple in construction and efficient in operation.

MESSRS. WALKER, BAILEY & CO., of Buenos Ayres, Argentine Republic, are now installing the first outfit of electric motors for supplying all of the motive power in a factory that has ever been installed in that country. The plant is for a weaving factory and is to be driven by Lundell electric motors of such power that each motor will drive six machines. There are instances where it is advisable when putting in electric motors to fit each machine with a separate motor, but in this instance the machines are always in operation; hence it is economical to install on the plan adopted by Walker, Bailey & Co.

ELECTRIC CABLES FOR THE GOVERNMENT.—It is stated that all of the multiple armored cored cable which the General Electric Company had in stock has been taken by the Government for the purpose of making submarine mine connections. It is also stated that the Government has contracted for the company's entire output of this class of cable for several months to come. The Government has also taken all the cable obtainable from other manufacturers and practically cleaned up the market of that sort of goods. It has given the General Electric Company, according to report, an order for a dozen large and powerful searchlights for the coast fortifications.

THE SPRAGUE ELECTRIC COMPANY, New York, has reserved sufficient space for a very comprehensive exhibit of its product at the Electrical Exposition, which is to be held at Madison Square Garden, May 2 to May 31, inclusive. The exhibit will comprise a type of each Sprague electric elevator manufactured by that concern; a direct connected lighting plant; Lundell power and fan motors; exhaust fan outfits; a printing machine in operation, together with blowing outfit; a cab of the London type, with automobile motor and Sprague controller; screw pumps; armatures; conduit; switchboards and conduit racks. The Sprague Company promises to make as complete an exhibit as has ever been made in its particular line.

ECONOMICAL BATTERIES.—In these days of sharp competition and low prices the first cost of a battery is sometimes considered a criterion of battery economy. Length of life and the amount of work done are quite as important, however, when estimating the cost of batteries. The manufacturer of the Samson battery states that it has succeeded in producing a battery which is capable of doing a large amount of work, and has a long life and great recuperative power. The carbon is manufactured in France, and by a process which makes it one of the most expensive carbon elements in use. Owing to its porosity and purity it is peculiarly adapted for battery use. The Electric Gas Lighting Company, 196 Devonshire Street, Boston, Mass., will send circulars and printed matter to anyone who is interested and will write for same.

THE WORK which the Electrical Engineer Institute of Correspondence Instruction has undertaken, of which mention has been made in these columns, has, it is stated, met with the unqualified approbation of the engineering profession. The institute is by permission allowed to refer as to its good faith, trustworthiness and technical reliability to eminent representatives of all branches of the electrical engineering profession, many of whom characterize the undertaking as a work which will benefit hundreds of ambitious workers who are anxious to entrust their technical education to a reliable institution. The institute has received appreciative communications from large numbers of men actively engaged in the profession, and is enabled to meet fully—with its many special courses—the varying needs of all interested parties.

THE RAPID INCREASE in the number of independent telephone exchanges has made the telephone supply business a very important department in the business of all of the electrical supply companies. One of the items used by telephone companies, for which there has been quite a large demand, is that of rubber covered telephone cables. The Paranite telephone cables, which are being sold in the West by the Electric Appliance Company, Chicago, seem to be securing a high reputation among telephone people. The Electric Appliance Company is in a position to make the most prompt delivery of these telephone cables, for the reason that it represents the only rubber covered wire factory located in the West. It is thus enabled to ship any ordinary order for special telephone cables from its Indiana factory within a very few days after the receipt of the same. The company is always pleased to submit samples at any time of what it is producing in this line.

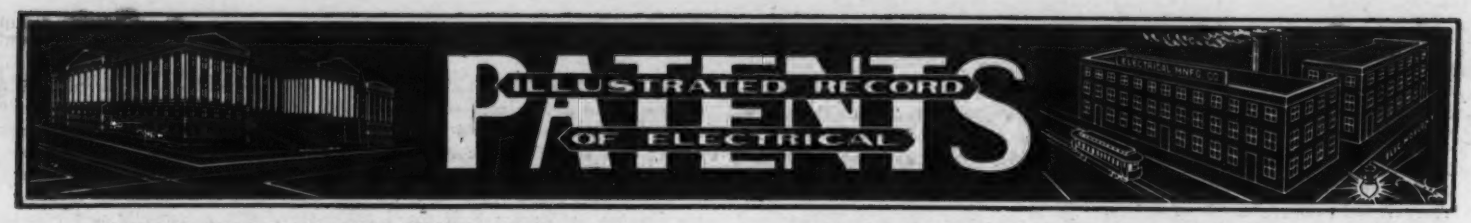
THE MONTAUK MULTIPHASE CABLE COMPANY, New York, has good reason to exult over the endorsement of its system of wiring by the Gamewell Auxiliary Fire Alarm Company, New York. In a letter from Mr. Joseph W. Stover, president of the Gamewell Company, that gentleman states that his company has come to the conclusion that it will find, through the use of multiphase electric cables, something long desired, but hitherto impracticable, viz., a device that can be safely used for the purpose of combining thermostatic fire alarms with that company's auxiliary system of connection with public fire alarm telegraphs. The fact that the Gamewell Company has adopted and endorsed this cable is an excellent testimonial of its merits. The unique feature of this cable is that it can be used for any and all kinds of interior electric service, at the same time affording an extraordinary protection against loss by fire, by automatically closing the fire alarm circuit in case of an outbreak of fire and thus sounding the fire alarm. A full description of this new form of cable was given on page 43 of THE ELECTRICAL WORLD of January 1, 1898.

THE CARD ELECTRIC COMPANY, Mansfield, Ohio, writes that its business was never better than it is now. It is receiving orders every day for its apparatus, and it has been necessary to run its shops at night. It has just completed some important extensions, and is looking forward to further additions to its plant in the early summer. Its recent sales of apparatus include a large number of motors and generators, among which are the following: One 15-kw direct connected generator to United States Government lighthouse, Detroit, Mich.; one 35-hp motor, Citizens Electric Street Railway, Light & Power Company, Mansfield, Ohio; one 40-kw generator, two 10-hp and one 5-hp motors to the Ohio Brass Company, Mansfield, Ohio; one 100-kw direct connected generator and one 5-hp motor to the Cleveland Ship Building Company, Lorain, Ohio; two 20-hp motors to the Cambridge Iron & Steel Company, Cambridge, Ohio; one 30-hp and one 15-hp motor to Chicago City Railway Company, Chicago, Ill.; eight electro-plating dynamos to Bennett & O'Connell, Chicago, Ill.; one 100-kw direct connected generator to the Ohio & Pennsylvania Coal Company, Cleveland, Ohio.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

DO YOU WANT A GOOD FARM for very little money?—We can put you in the way of getting fine farm lands in South Dakota for $10 per acre and upward, one-third cash, balance on easy terms. Send for descriptive list of lands and for free illustrated pamphlet on South Dakota containing numerous letters from farmers in the finest agricultural and stock-growing Western State. Address George H. Heafford, General Passenger Agent Chicago, Milwaukee, and St. Paul Ry., Old Colony Building, Chicago, Ill., or H. F. Hunter, Immigration Agent, 291 Dearborn Street, Chicago, Ill.

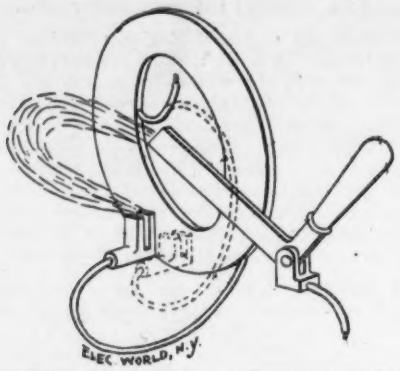


UNITED STATES PATENTS ISSUED APRIL 5, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

601,626. BOWLING ALLEY; E. Brooks, Milton, Mass. App. filed Feb. 23, 1897. In a bowling alley an electric circuit broken at the spot where the pin stands; two binding posts set upon the circumference of a suitably sized circle struck from the centre of the spot, their tops flush with the surface of the alley and 90 degrees apart, and a pin having a metal ring inlaid upon the bottom thereof flush with its bottom surface and of suitable size to connect the two binding posts.

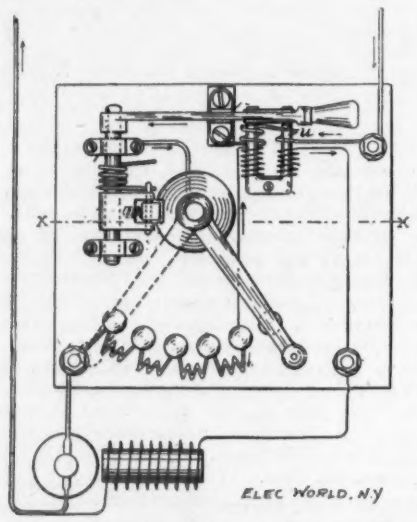
601,694. MACHINE FOR RESTORING INSULATED WIRE; N. Wilson, Portland, Ore. App. filed Aug. 20, 1897. A machine with a straightening device for straightening old insulated wire, and a stripping device in advance of said straightening device for removing the insulation from the wire.



No, 601,717.—Solenoid Blow-out for Dispersing Arcs Formed in Breaking Electric Circuits.

601,707. RAIL BOND; J. J. Dainton, Chicago, Ill. App. filed Feb. 15, 1897. A rail bond provided with terminal sleeves entering tapered holes in the rail web or flange from the larger end of the hole and removably expanded therein by tapered drift pins inserted from the same side as the rail bond, said drift pins being longer than the terminal and arranged to project at each end thereof and the end of the terminal being left substantially flush with the face of the rail so as to prevent the expansion of the metal under the action of the drift pin from forming a bead or head to interfere with the removal of the bond.

601,717. SOLENOID BLOW-OUT FOR DISPERSING ARCS FORMED IN BREAKING ELECTRIC CIRCUITS; S. H. Short, Cleveland, Ohio. App. filed Nov. 1, 1897. The combination with separable contacts arranged in an electric circuit of a spiral conducting coil arranged in proximity to said contacts and normally in shunt circuit therewith, said coil adapted to be introduced in the circuit of said contacts at the moment the circuit is broken between said contacts.



No. 601,871.—Electromagnetic Circuit Breaker

601,730. HEAT DETECTOR FOR ELECTRIC FIRE-ALARM SYSTEMS; J. D. Gould, Brooklyn, N. Y. App. filed Jan. 30, 1896. In an electric fire alarm, in combination, an insulated block, a recess or chamber in said block, a bulb or globule or knob of fusible metal or compound of metal suspended over said recess, and two wires or conductors extending into said recess independent of and insulated from each other, an electric cable or conductor composed of a central core of copper or other electric wire, a covering of fusible metal or compound of metal over said central wire, an insulating material over said fusible metal, an electric wire or wires wound upon the insulating material and an insulating material covering the whole, the central wire, with its fusible metal covering, and the electric wire wound upon the insulated block and respectively to the two poles of an electric battery.

601,758. ELECTRIC LANTERN; O. C. Prasse, West New Brighton, N. Y. App. filed June 28, 1897. A battery, comprising a casing having a removable head thereon and a depending cylindrical carbon attached to said head, an inclosed porous cup and a removable zinc contained within said cup, said cup and the said casing adapted for respectively containing chemical compounds, the said head having a diagonal vent containing mercury leading these through for escape of gases.

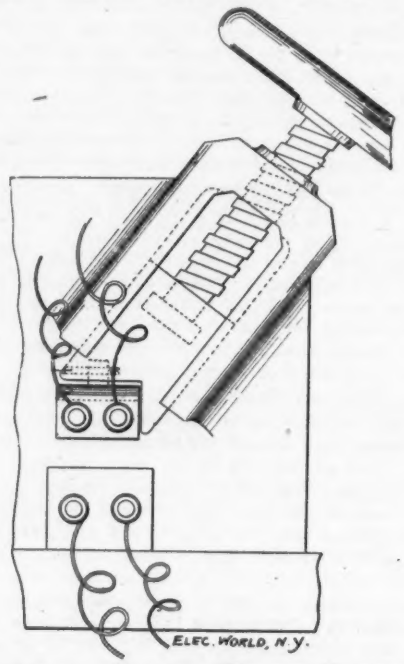
601,768. PRINTING TELEGRAPH SYSTEM; J. Burry, Fort Lee, N. J. App. filed Sept. 10, 1897. In a printing telegraph system, the combination of a line, a receiver provided with printing and polarized type controlling electromagnets operated by the line current, an automatic current reverser in said line intermediate the source of electrical energy and said receiver, and adapted to be held close while a transmitter key is held closed, a "ground" through non-inductive resistance normally disconnected from the line and located between the said reverser and said receiver, and a two-way switch in said line between said reverser and said receiver, arranged to throw the battery off and on and simultaneously to connect and disconnect the said "ground" and the receiver end of the line.

601,786. LOCK FOR TELEPHONES; R. H. Allen, Fitchburg, Mass. App. filed Sept. 3, 1897. A means for preventing unauthorized use of a telephone, consisting of a base plate and bracket, adapted to be secured in proximity to the call means of the instrument, and a swinging arm supported by the base plate or bracket, and adapted to engage the call means and to be locked in engaged position and to be unlocked with a key.

601,865. TELEPHONE; T. F. Ahern, Detroit, Mich. App. filed April 26, 1897. A transmitter suspended on a horizontal axis in a plane in or parallel to the diaphragm, so journaled that the speaking tube is normally downward, and means connecting the movable receiver hook with the transmitter, compelling the latter to rotate so that the diaphragm is in substantially a perpendicular plane when the receiver is detached from the hook.

601,871. ELECTROMAGNETIC CIRCUIT BREAKER; G. S. Dunn, East Orange, N. J. App. filed June 12, 1897. The combination of an electromagnetic circuit breaker, a resistance controlling switch, means controlled by the resistance controlling switch for locking the circuit breaker against closure in certain positions of the switch, and means for permitting the opening of the circuit breaker in all positions of the switch.

601,979. ELECTRIC WELDING MACHINE; C. Neilsen, Brooklyn, N. Y. App. filed June 15, 1897. The combination with the vise, comprising a frame, a screw and a sliding block, provided with a circular recess in its centre, set in the frame and connected to the screw, of a clamping jaw,



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having its top beveled from centre to its sides, a dove-tail groove in its apex, a pivoting device having a dove-tail shaped base, and a circular head, and of a screw passing through the head of the pivoting device and through the sliding block, and connecting the clamping jaw to the sliding block of the vise.

601,992. ELECTRIC BRAKE MECHANISM; A. Vanderbeck, Scammon, Kan. App. filed Sept. 13, 1897. An electric brake operating device, having fixed electromagnets, and a movable plunger operating axially through one electromagnet, with its extremities permanently located beyond the ends thereof, for attraction by the other, and adapted to be operatively connected with brake mechanism.